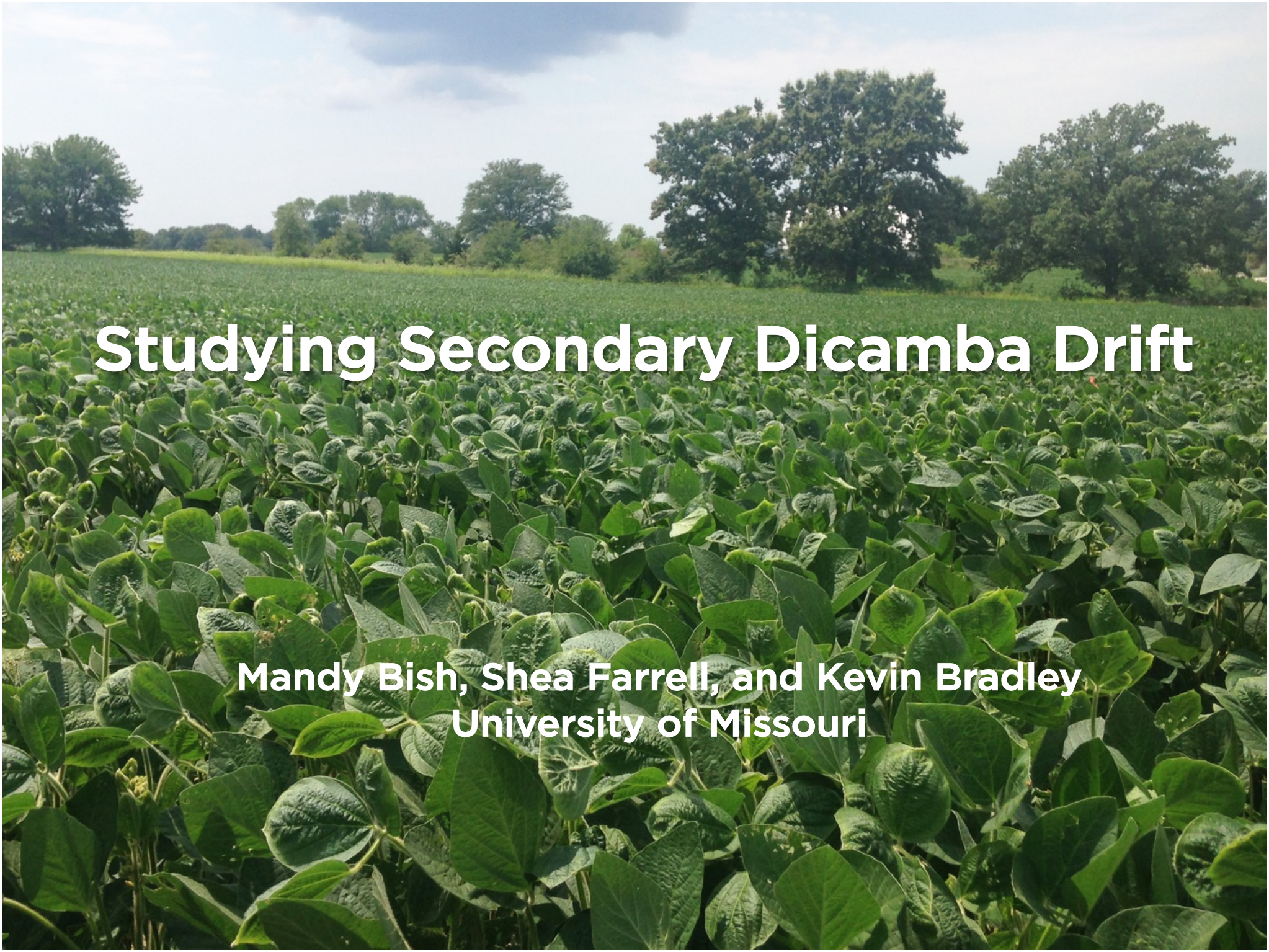


Studying Secondary Dicamba Drift

Mandy Bish, Shea Farrell, and Kevin Bradley
University of Missouri

Studying Secondary Drift

Occurs when pesticide droplets move after the application

Does not typically leave a distinct injury pattern

Commonly associated with environmental and weather factors

- volatility
- temperature inversions
- runoff
- binding to dust

Mizzou weed science

Secondary Drift

An example

How/why is dicamba moving?

If we can understand it, we increase our ability to reduce it.

Presentation summary:

Inversion monitoring update

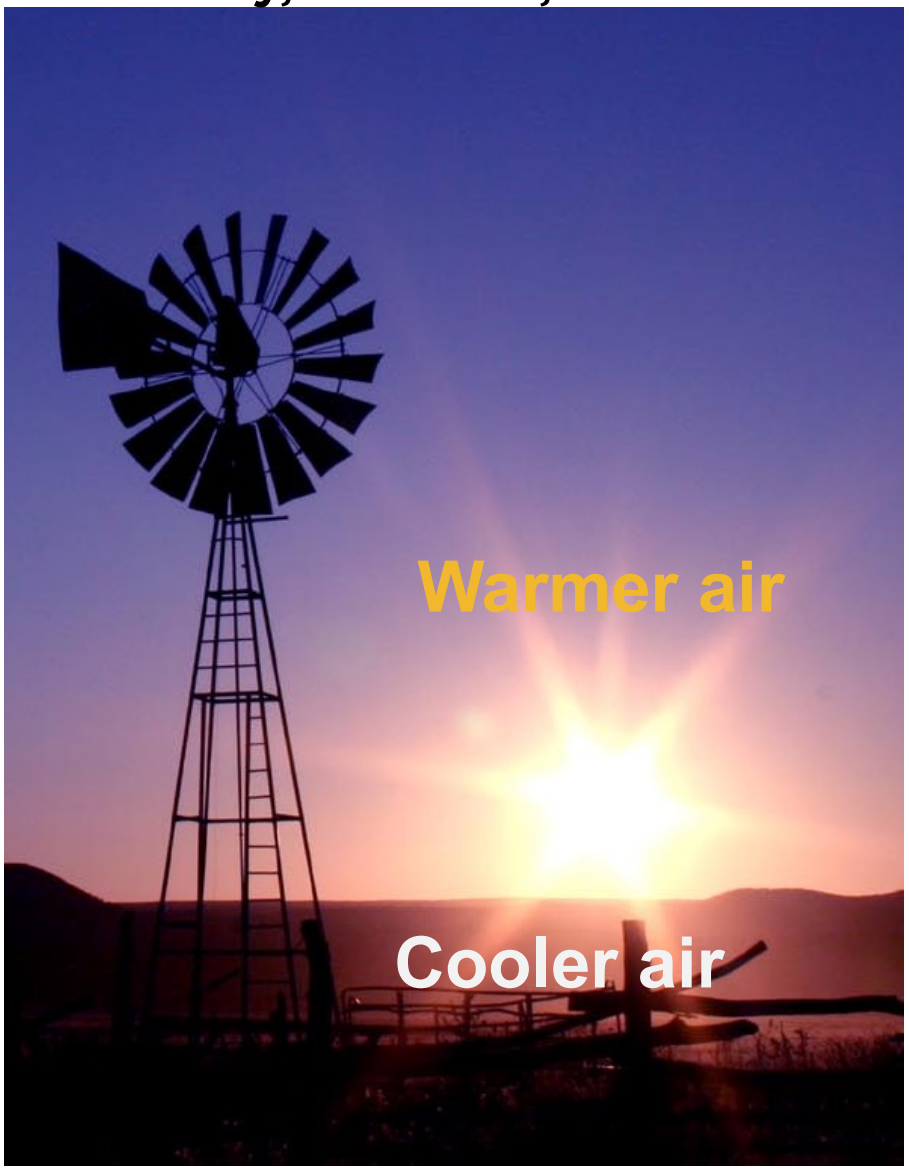
Air sampling study

Environmental study

Monitoring inversions review & update

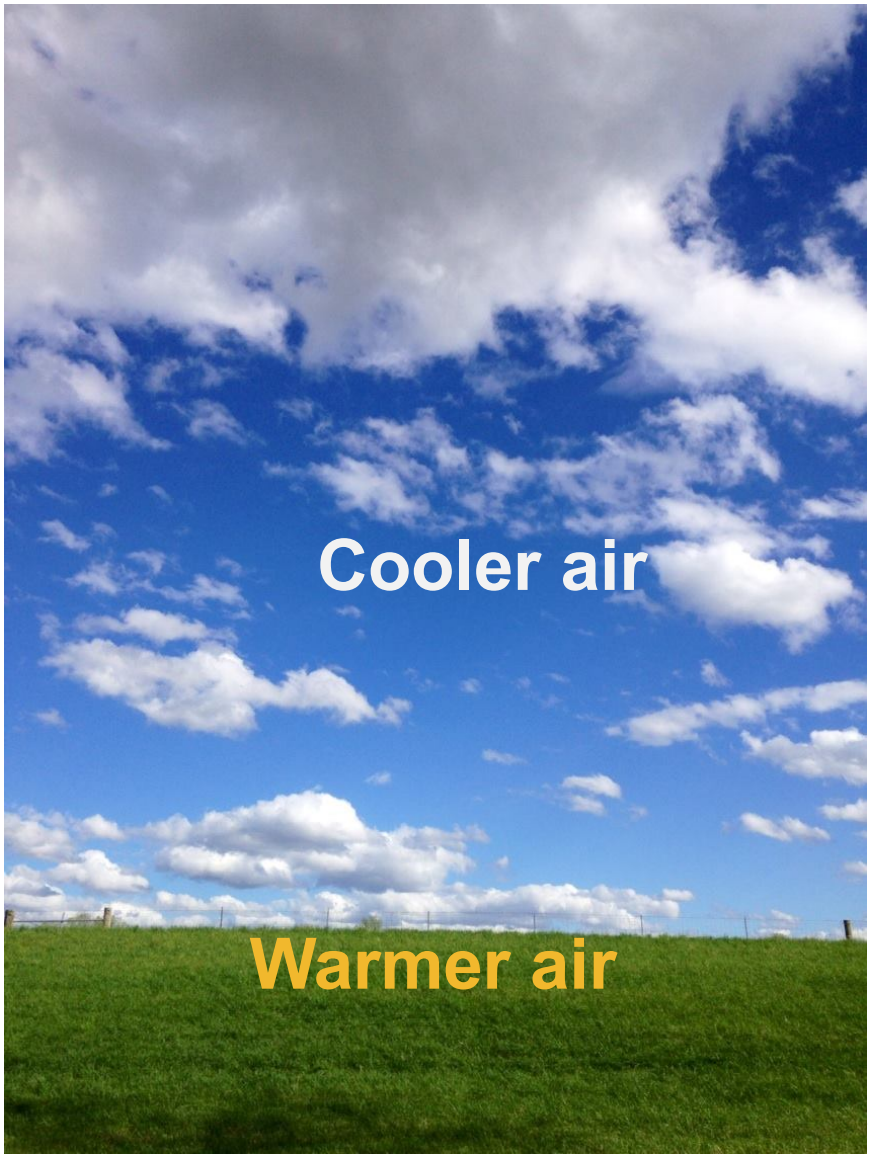
+ inversion

Clear sky, no wind, near dusk



no inversion

Cumulus clouds, wind



Inversions result in stable air masses. Particles can be suspended in these air masses. Smoke bombs are a good visual of this.

Released at 4:00, No Inversion Present

Released at 7:30, Inversion Present

Surface-level temperature inversions are common during Missouri evenings

Three-year trend for time that inversions began forming, Columbia, MO (2015-2017)

		Start Time		
Month	Number of inversions	Average start time	Earliest	Latest
April	58	6:07 PM ± 1 hour	4:10 PM	11:25 PM
May	56	6:16 PM ± 2 hours 20 minutes	2:50 AM	11:20 PM
June	53	6:01 PM ± 3 hours 26 minutes	0:01 AM	10:25 PM
July	46	7:03 ± 30 minutes	5:15 PM	8:40 PM

Three-year trend for duration of inversions, Columbia, MO (2015-2017)

		Duration		
Month	Number of inversions	Average duration	Shortest	Longest
April	58	11:26 ± 3 hours	1:30	16:50
May	56	10:19 ± 2 hours 41 minutes	1:10	15:00
June	53	9:53 ± 2 hours 39 minutes	1:25	12:55
July	46	9:08 ± 2 hours 39 minutes	3:30	12:55

This is one example. For more information on inversions in Missouri check out the slide show "Knowing When to Spray, monitoring historical and real-time weather."

But how do inversions contribute to off-target dicamba movement? Is it:

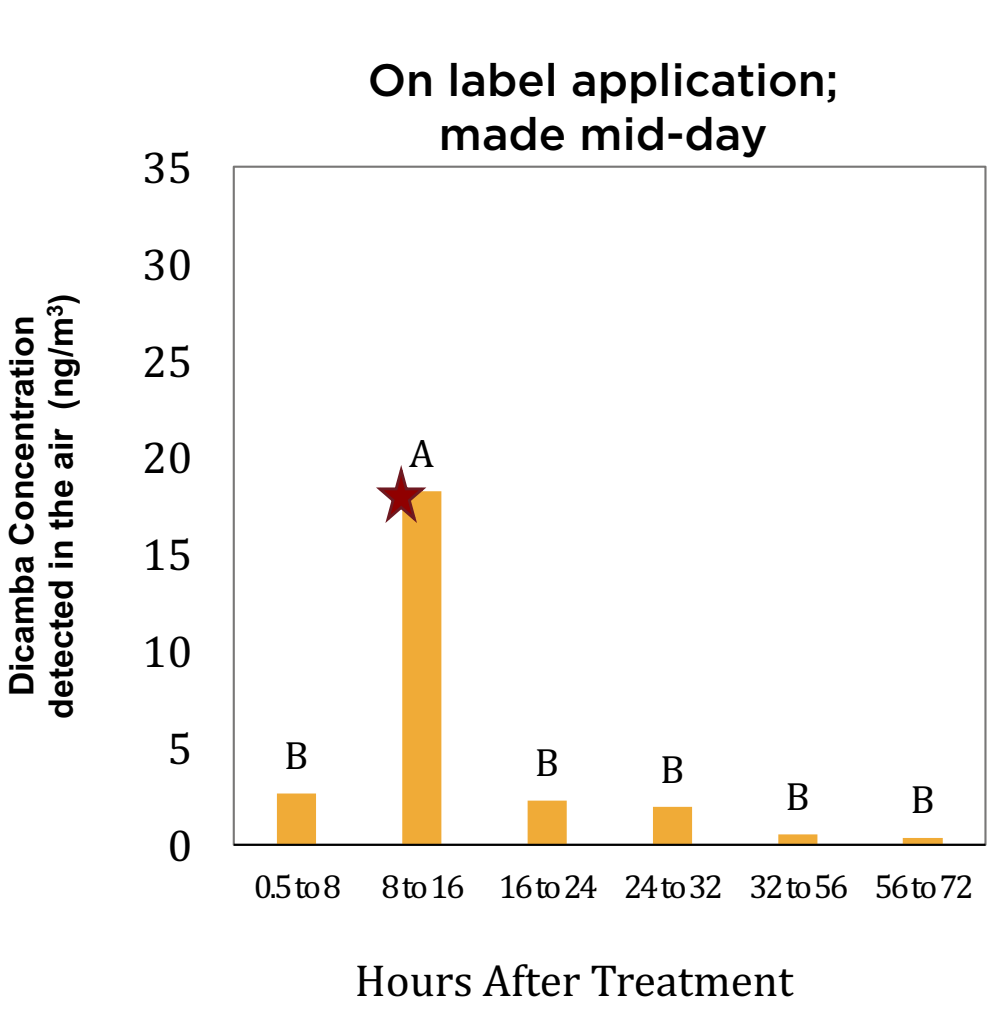
1. By herbicide droplets being suspended in the stable air mass when applied during inversion conditions?

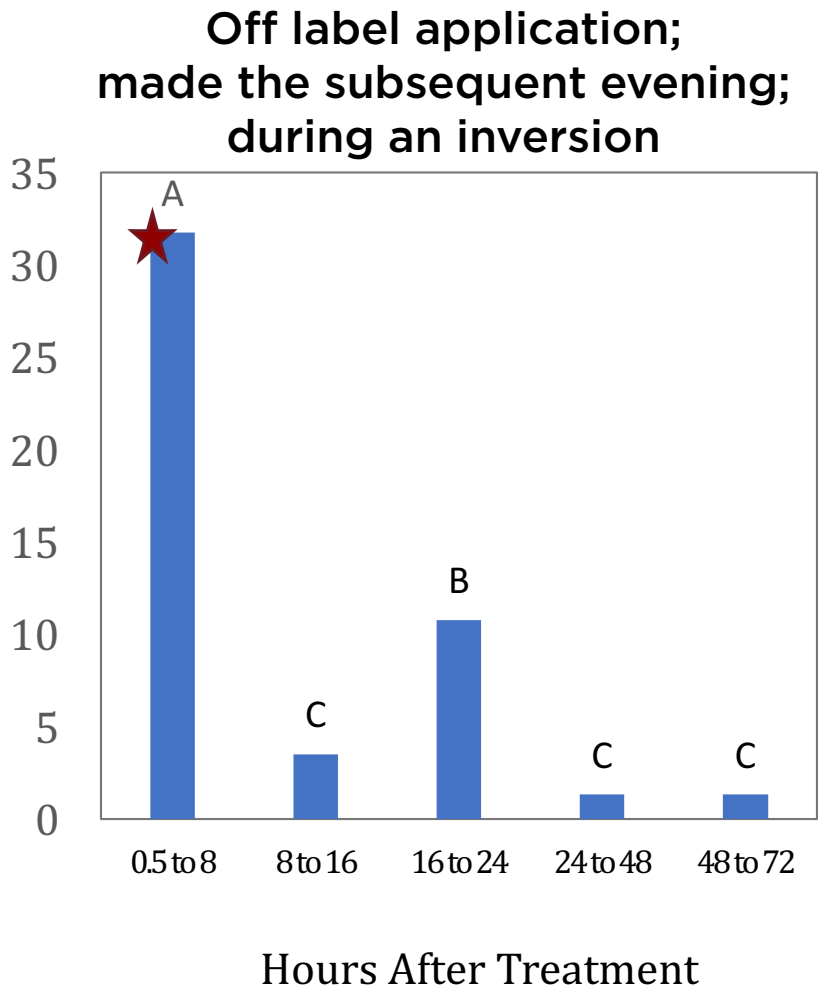
2. By volatilizing or moving into the stable air mass after an inversion forms?

3. Some combination of both?

Studying dicamba in the air

★ In this study, most dicamba was collected in the evening regardless of application time.





Graphs are averages of 2 studies with 3 air samplers per application

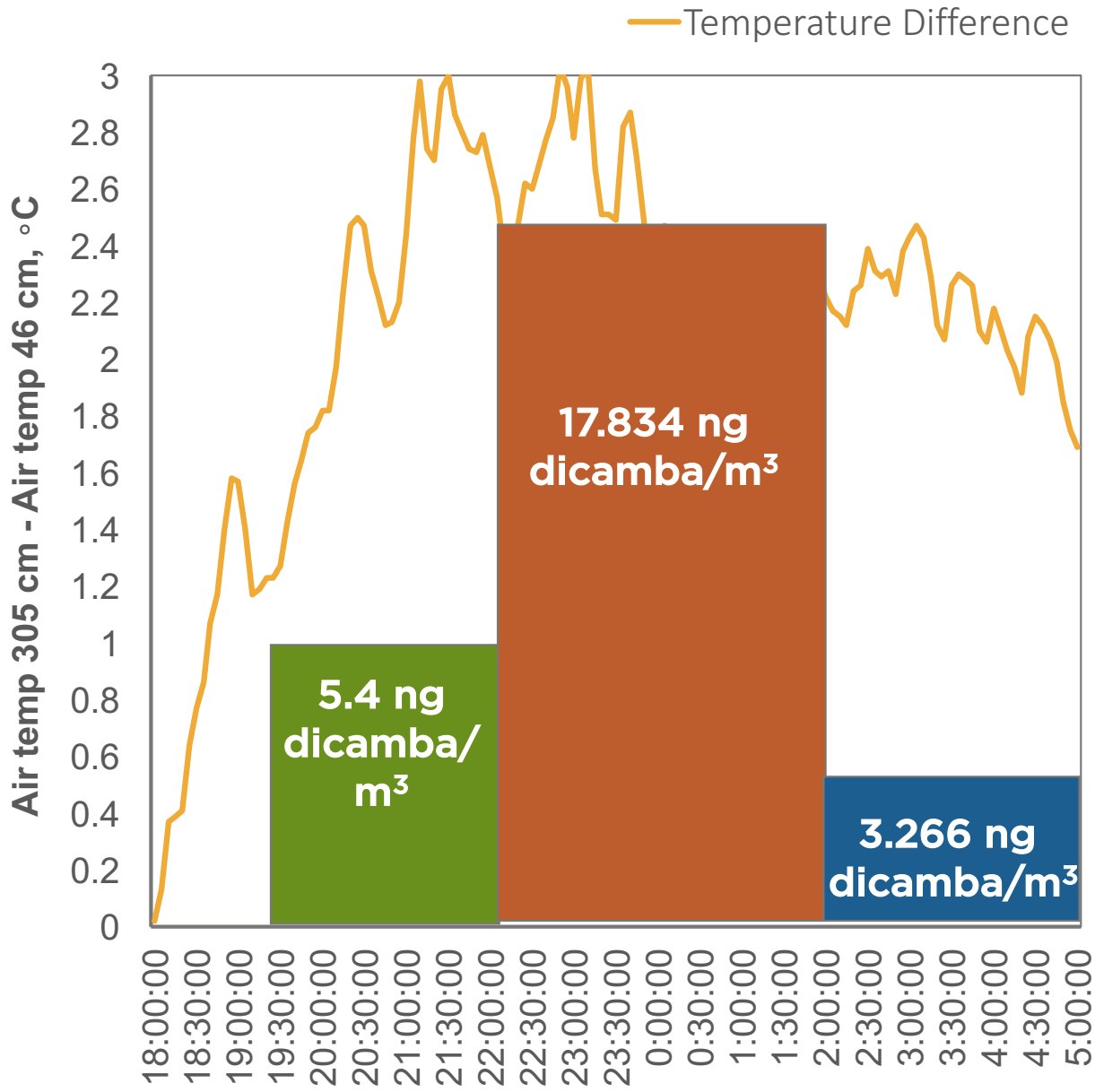
Studying dicamba in the air

Dicamba application made in the evening as an inversion formed

Larger the air temp difference = 'stronger' the inversion

Dicamba was detected throughout the evening NOT only at time of application

These preliminary air sample results provide support for a role of atmosphere stability



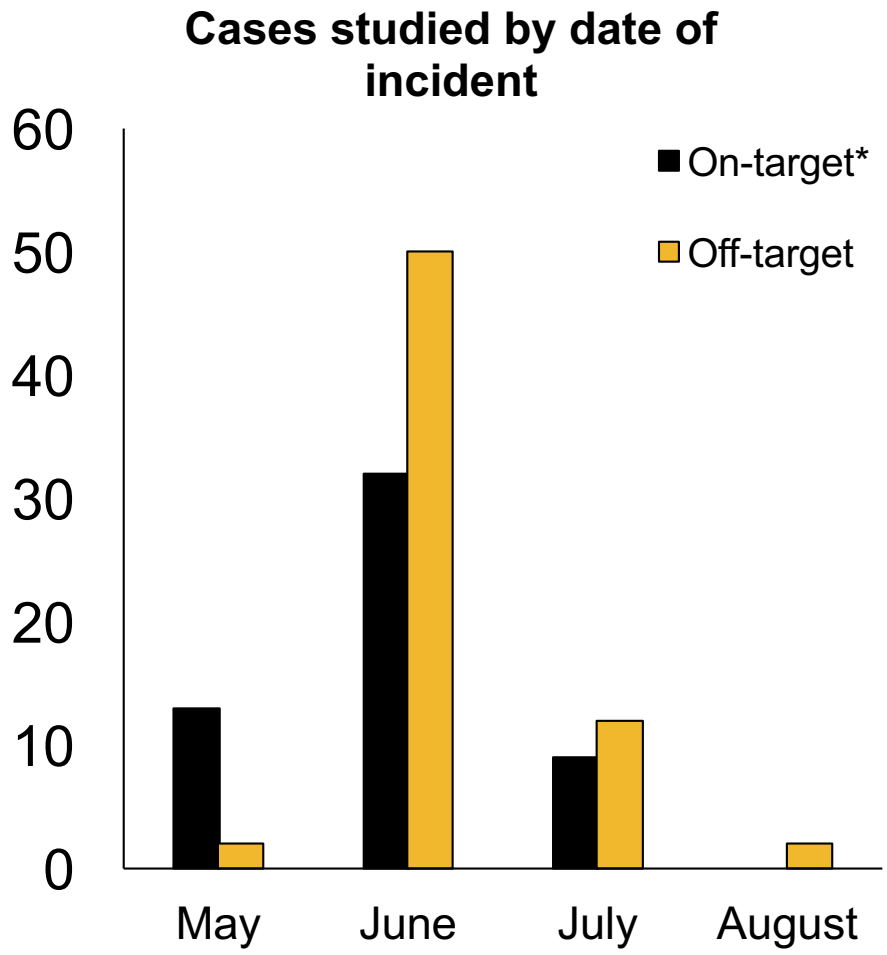
(June 8-9, 2017 Columbia, Missouri)

From the lab to the field: What can we learn from 2017 'real world' applications?

Data studied:

54 successful applications*
- Missouri
- Kansas

66 applications resulting in OTM
- Missouri
- Kansas
- North Carolina
- Canada



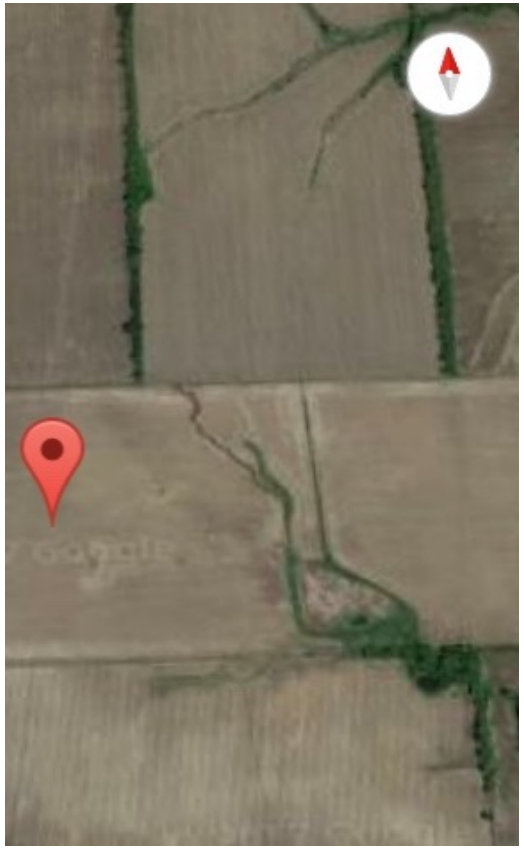
Successful vs Off-target Applications

Data retrieved:

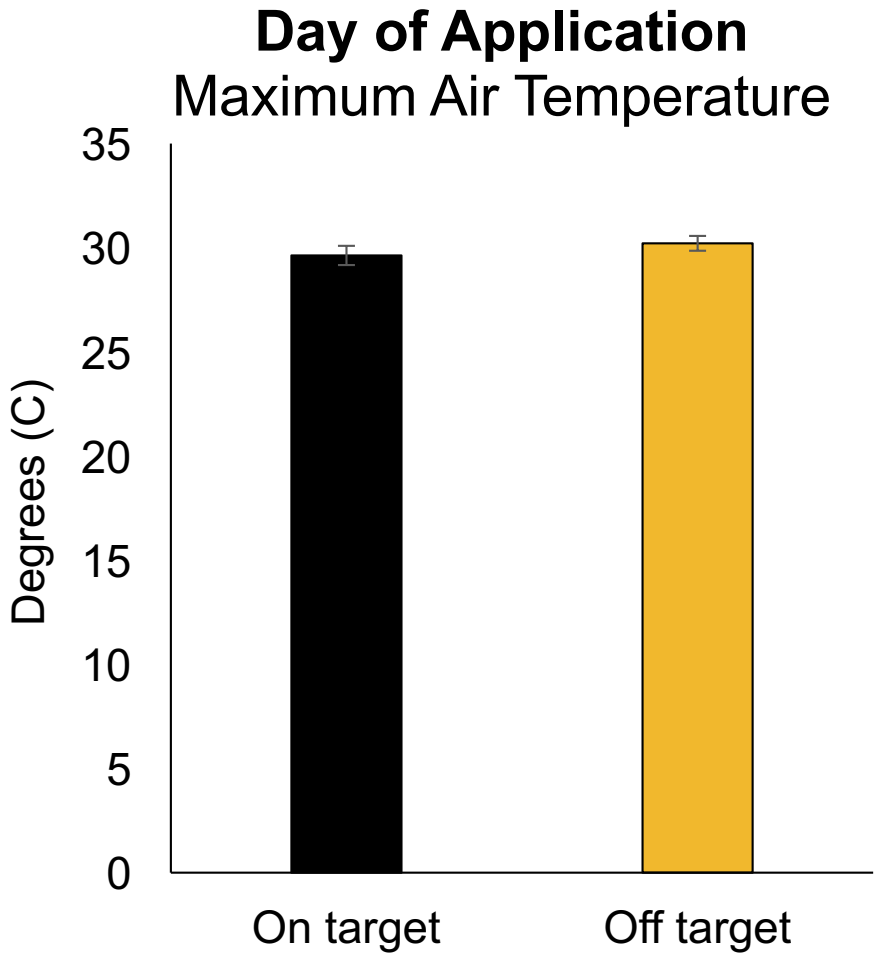
- Max air temp
- Ave air temp
- Max wind speed
- Total precipitation

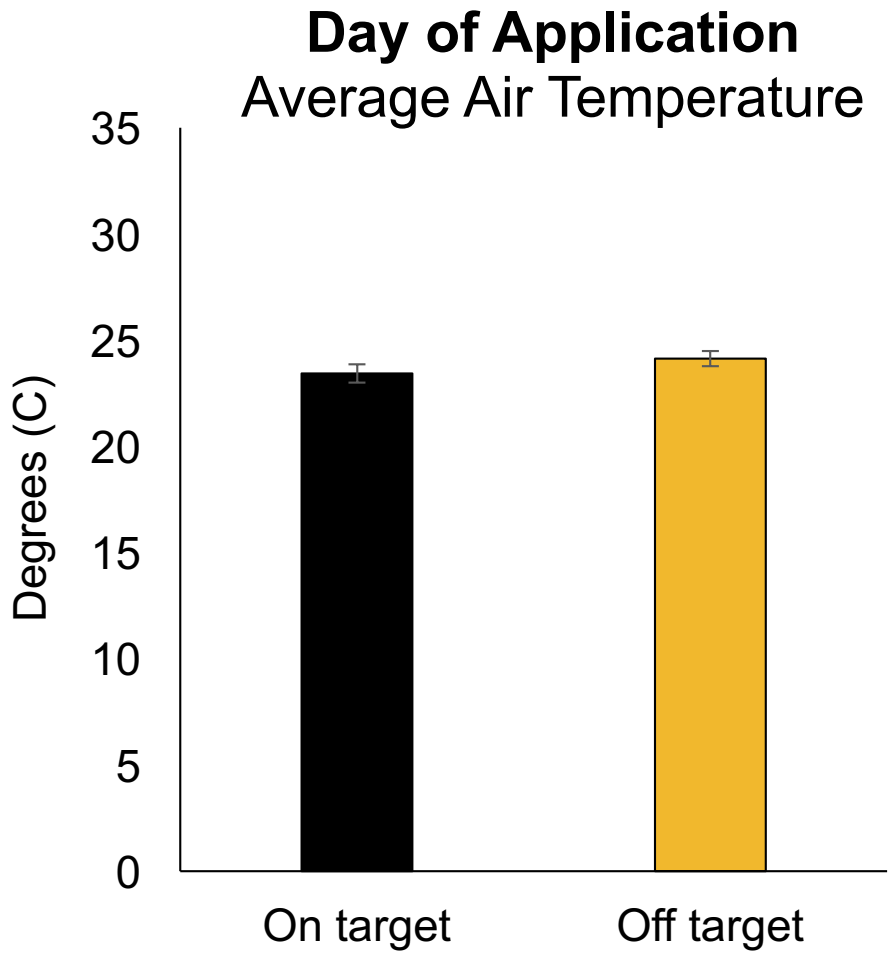
Weather data from the nearest state-maintained station was used

Data for day-of and day-following application were studied



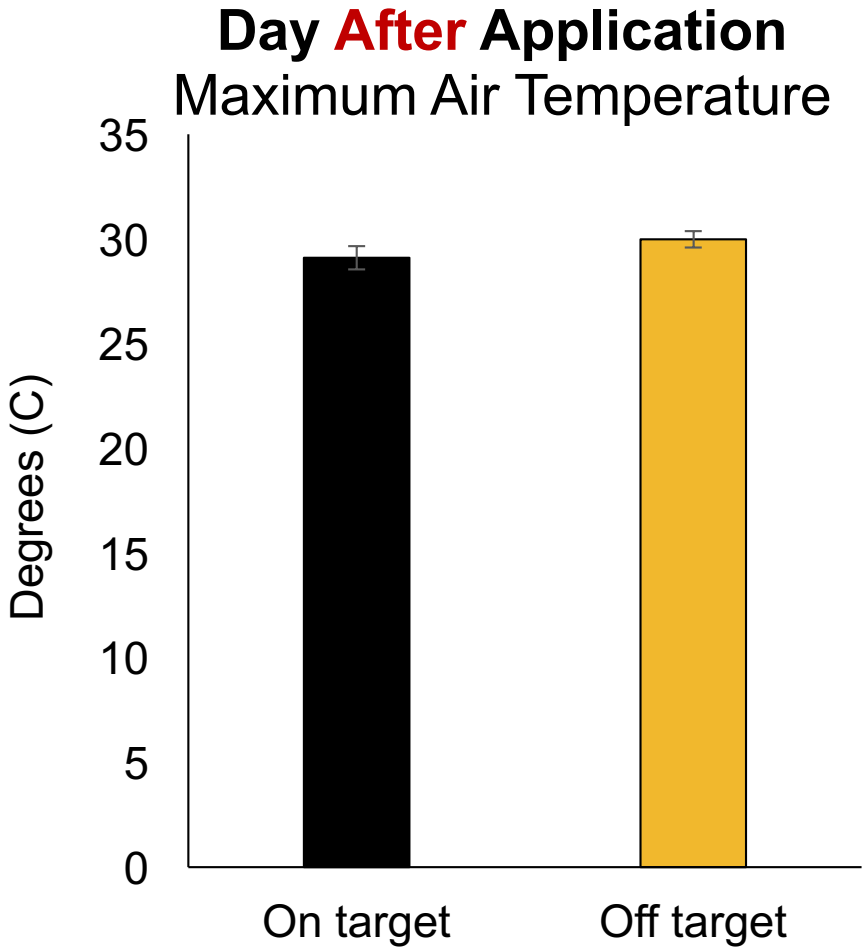
Air temperatures alone seem insufficient to explain off-target movement

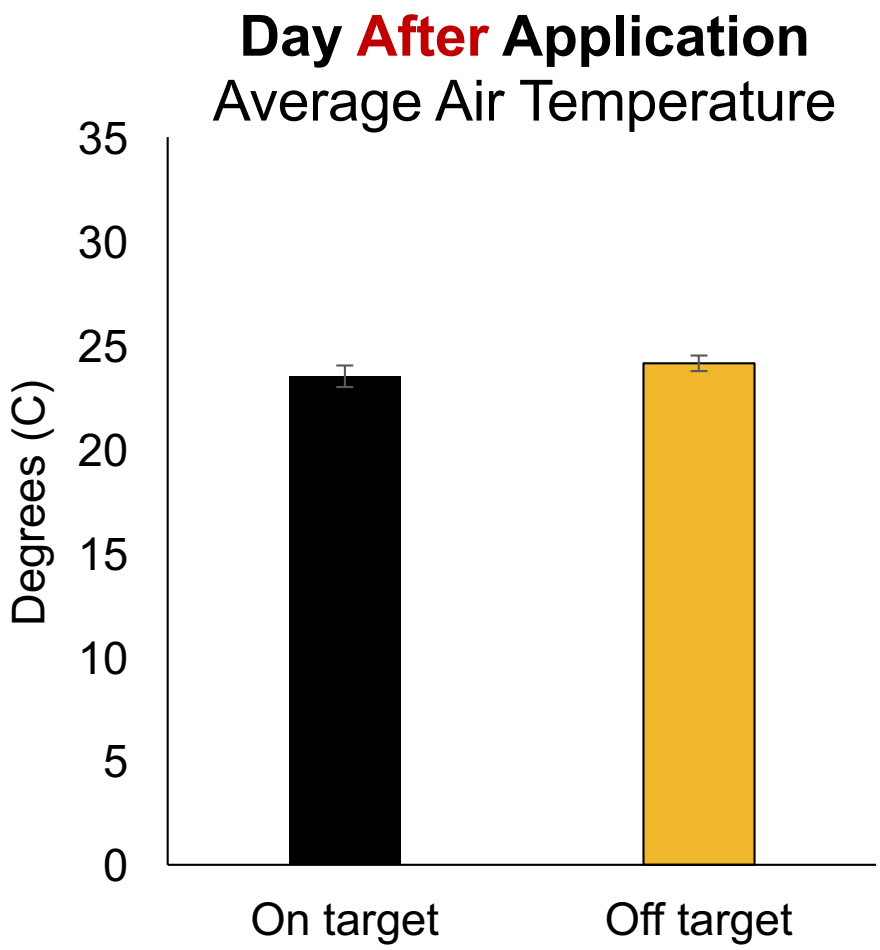




*Error bars represent standard error of the mean

Air temperatures alone seem insufficient to explain off-target movement





*Error bars represent standard error of the mean

What can we learn when application date is unknown?

Data studied

54 successful applications* across 3 months

- Missouri
- Kansas

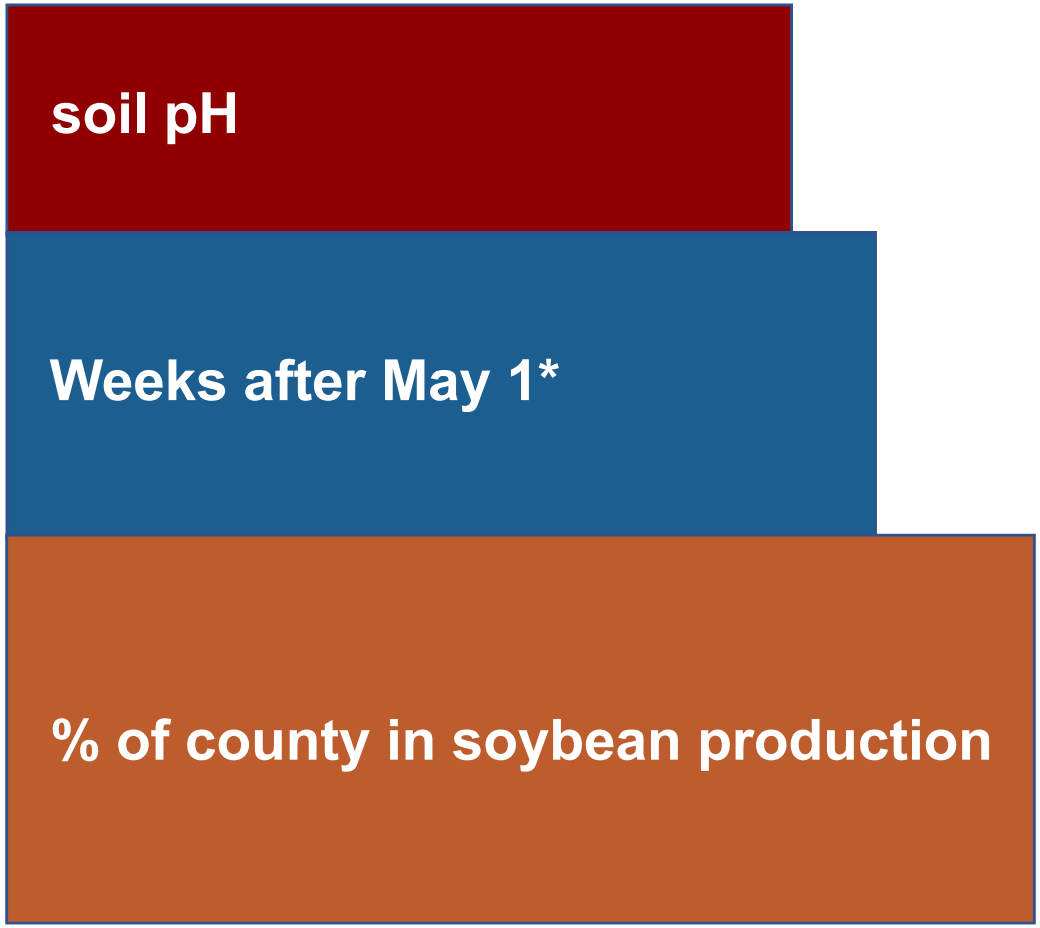
124 applications resulting in OTM

- Missouri
- Kansas
- North Carolina
- Canada
- Tennessee
- South Dakota

Data retrieved

- Soil pH information from NRCS's Web Soil Survey
- Soybean acreage from National Ag Census Data
- Date injury observed

Can we use the data to predict a successful vs off-target application?



What can we learn when application date is unknown?

Can we use the data to predict a successful vs off-target application?

Preliminary data suggest soil pH may be an indicator.
Soil pH of successful applications was estimated to be 6.31.
Soil pH of unsuccessful applications was estimated slightly lower 6.18.

Characteristic	On-target (n=54)	Off-target (n=123)	p-Value
Soil pH	6.31 (±0.04)	6.18 (±0.04)	0.0141
Weeks after May 1	7.9 (±0.34)	8.8 (±0.25)	0.0362
% Soybean Acres	23.7 (±1.2)	24.1 (±0.85)	0.796

Summary

- Secondary drift is not an easy problem to investigate.
- Multiple factors are likely at play.
- Air temperatures alone seem insufficient to explain the differences between 'successful' & off-target applications in 2017.
- Atmosphere stability likely plays a role. This would make sense in that dicamba droplets could accumulate in a stable air mass and be moved off-target altogether in a wind gust.
- Soil pH may play a role. Soils estimated to have a lower pH were associated more closely to the off-target cases.

Mizzou weed science