

Influence of Formulations and Application Time of Day on Dicamba Air Concentrations Following Treatment

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Objectives

To determine how the following affect concentrations of dicamba detected in the air:

1. New formulations
2. Time of application
3. Surface temperature inversions

Materials & Methods

- Dicamba-tolerant soybean planted in three geographically-separate regions of Bradford Research Center (≥ 480 meters apart).
- Air samplers placed equidistantly within 6 x 31 m plots and 31 cm above the canopy prior to dicamba applications.
- Dicamba applications made at 1X rate according to label requirements.
- The dicamba-collection substrates, glass fiber filters and polyurethane foam substrates (PUF plugs) were replaced at set intervals following treatment.



Materials & Methods

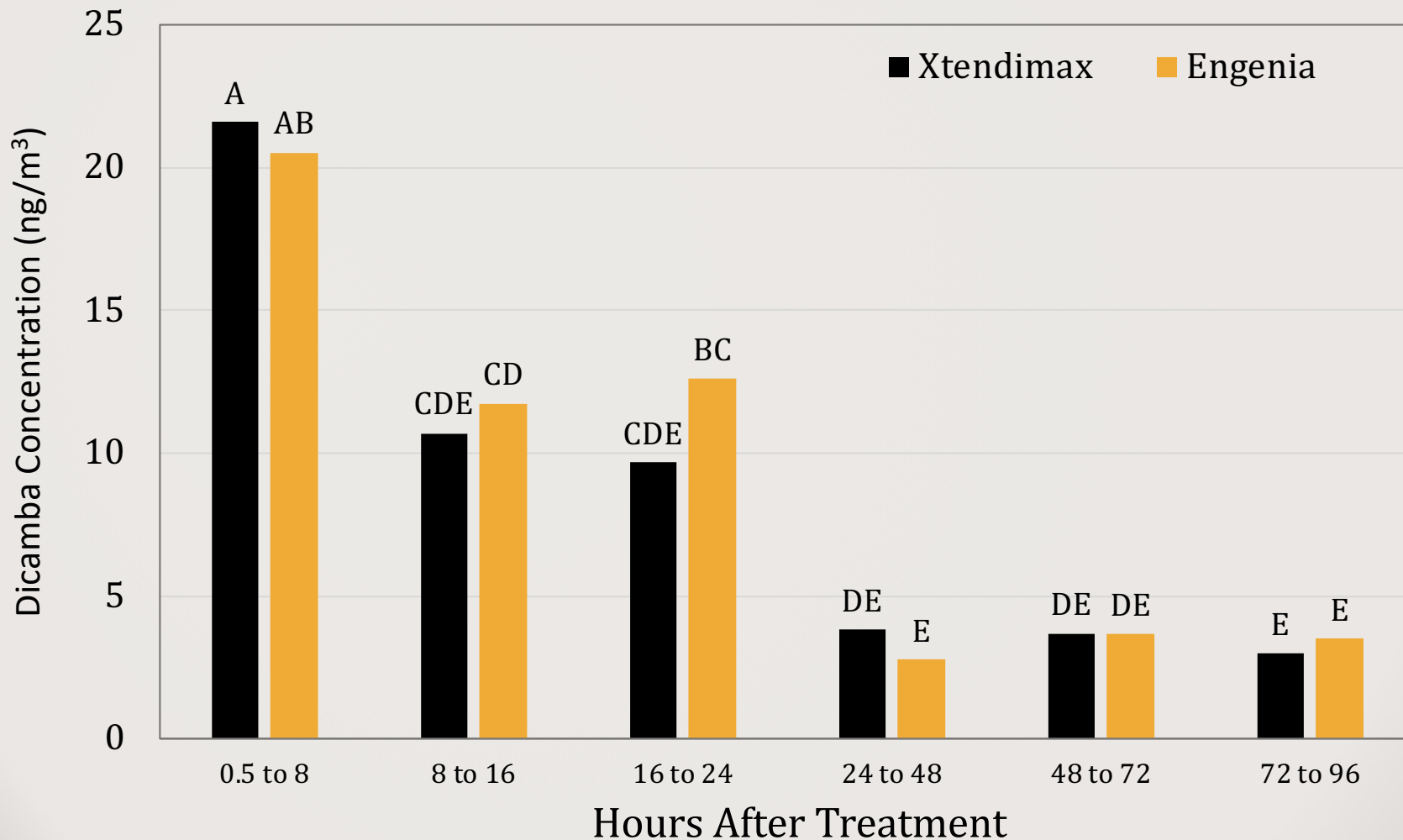
- A methanol rinse was used to extract dicamba from substrates.
- Dicamba was detected with a Shimadzu Nexera XR LC-20AD Liquid Chromatograph with diode array detector.
- Prior to the field study, spiked solutions were prepared, injected on and extracted from PUF and glass fiber substrates to determine recovery rate.
- Data was analyzed using SAS PROC GLIMMIX or PROC CORR procedures. Means were separated at the 0.05 or 0.001 levels of significance, respectively.



Objective 1: New Formulations

Dicamba Detection Following Engenia and Xtendimax Applications

Applications included **glyphosate K⁺** in the afternoon or evening, **no inversion present**



Results from two experiments, with 3 air samplers per experiment (n=96).

Means followed by the same letter are not different, LSD = 0.05.



Objectives 2 and 3:

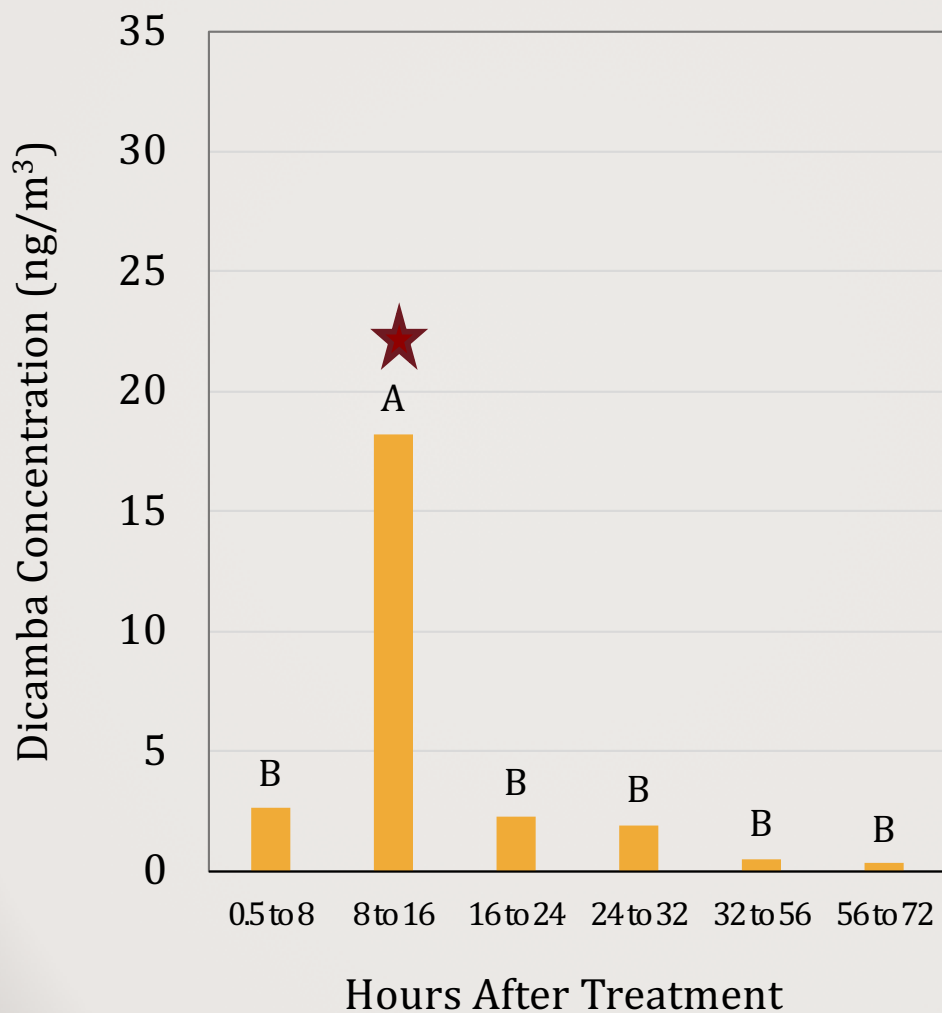
Time of Application

Surface Temperature Inversions

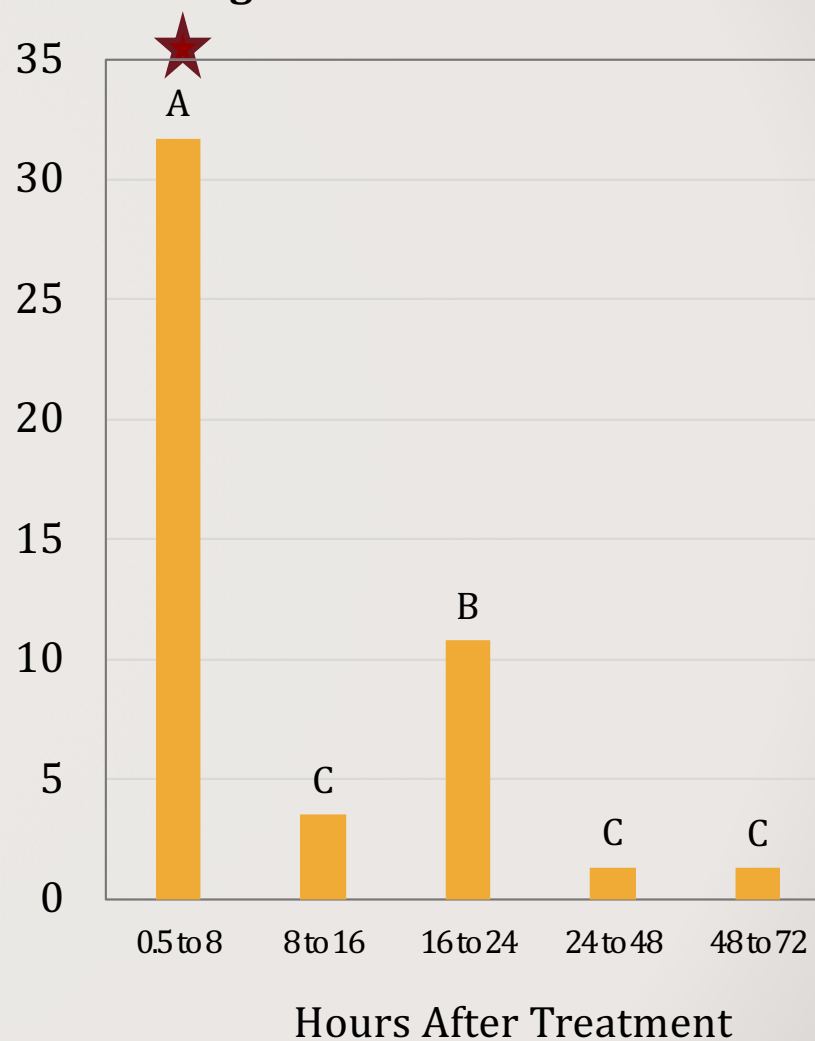


Time of Application

Application made **during the day;**
no inversion present.



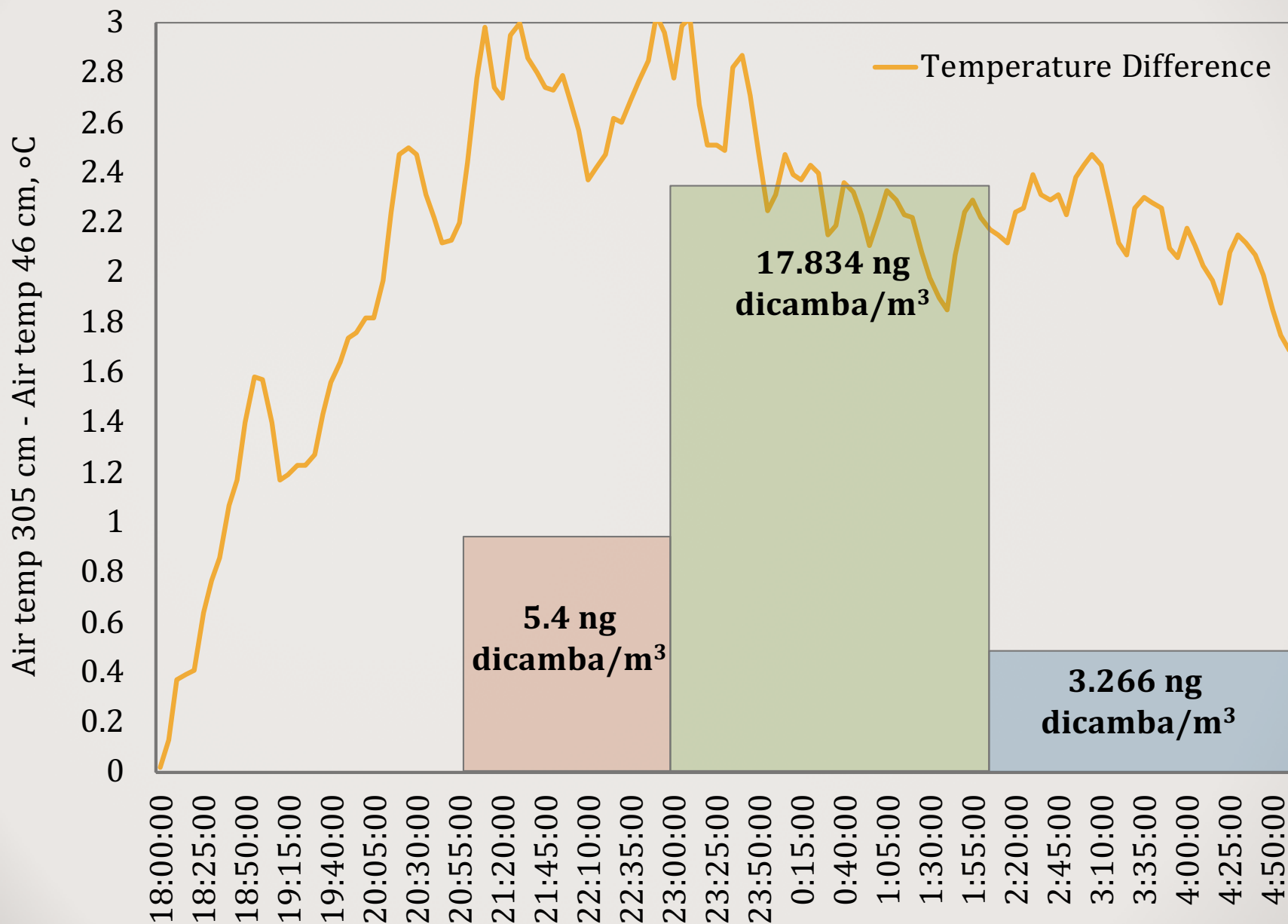
Application made **in the evening;**
during an inversion.



Results from two experiments, with 3 air samplers per experiment.
Means followed by the same letter are not different, LSD = 0.05.



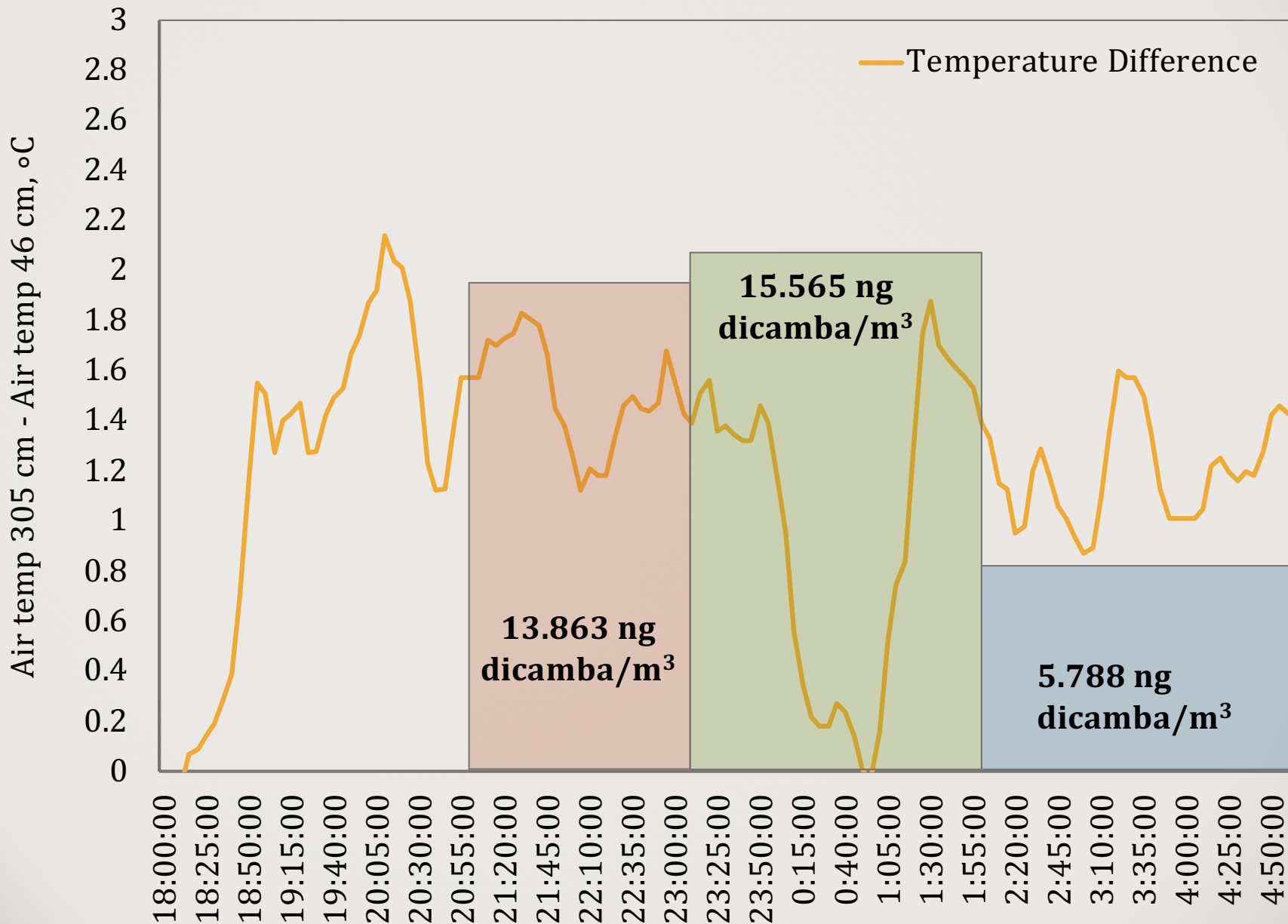
Air Temperature and Wind Profile on the Evening of June 8, 2017 Columbia, Missouri



*Inversion conditions met (TD \geq 1.2 C); wind speeds \leq 2.07 m/s or 4.6 mph at 305 cm



Air Temperature and Wind Profile on the Evening of June 20, 2017 Columbia, Missouri

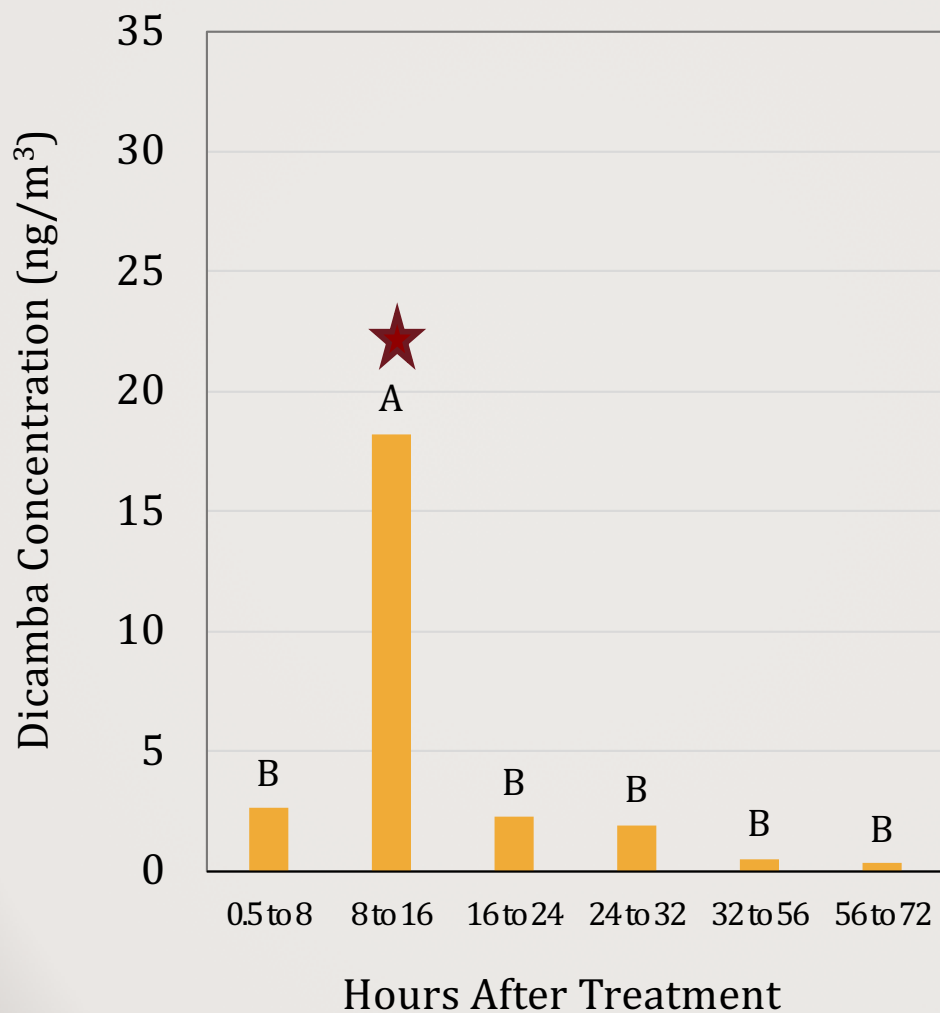


*Inversion conditions met (TD \geq 1.2 C); wind speeds \leq 2.25 m/s or 5.0 mph at 305 cm

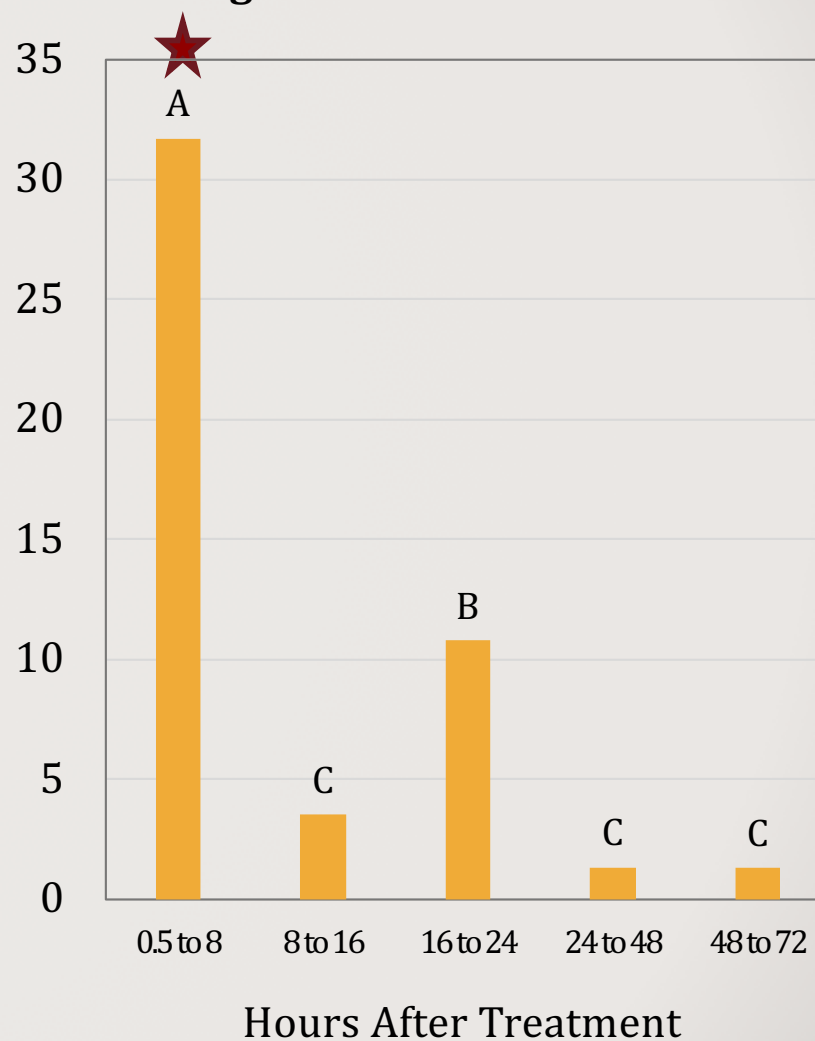


Time of Application

Application made **during the day;**
no inversion present.



Application made **in the evening;**
during an inversion.

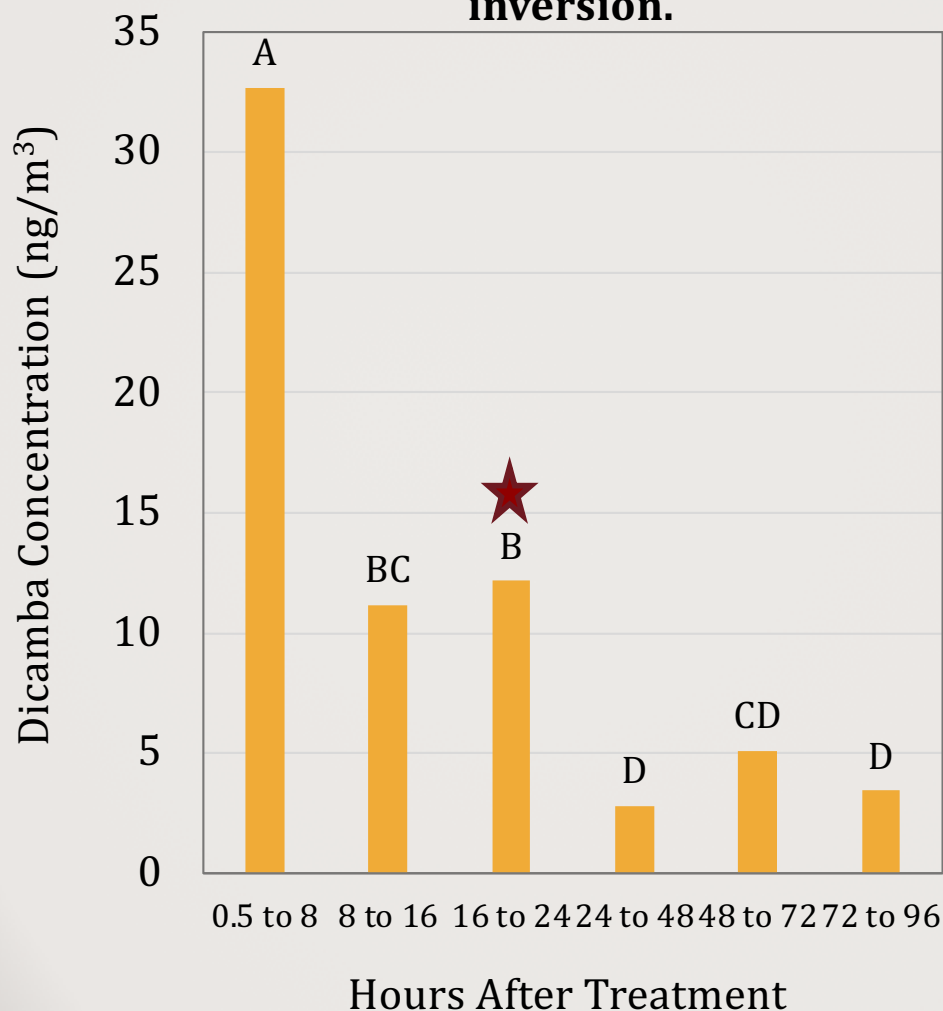


Results from two experiments, with 3 air samplers per experiment.
Means followed by the same letter are not different, LSD = 0.05.

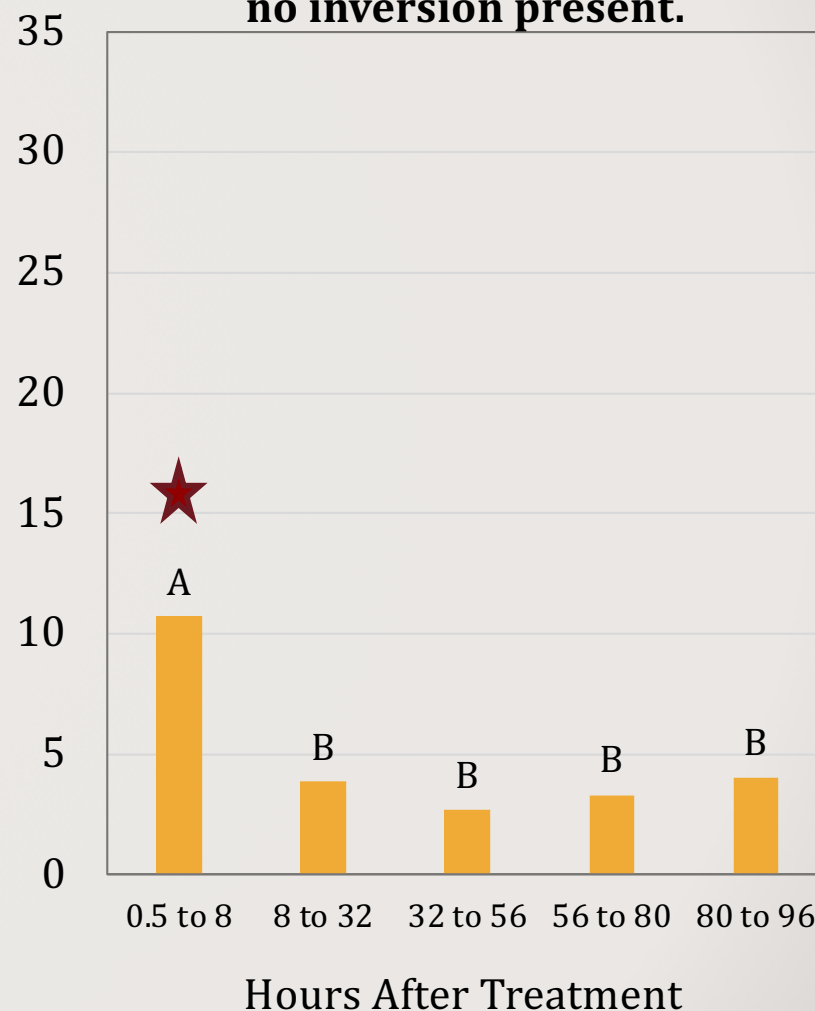


Time of Application

Application made **in the evening**,
with glyphosate K⁺, during an
inversion.



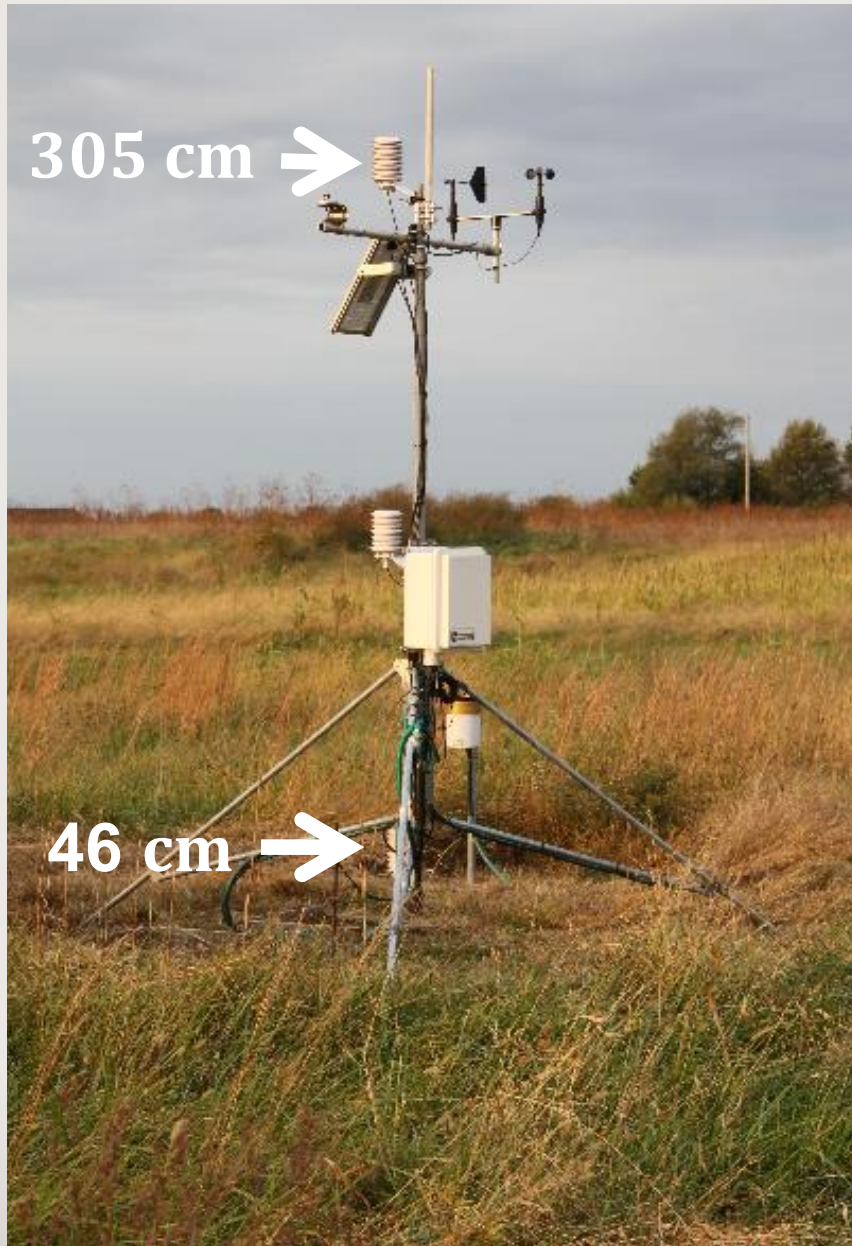
Application made **the following**
afternoon, with glyphosate K⁺,
no inversion present.



Results from five experiments, with 2 or 3 air samplers per experiment.
Means followed by the same letter are not different, LSD = 0.05.



The impact of inversions on dicamba detection?



Calculating lapse rates

$$\text{Lapse rate} = \frac{\text{AT (46 cm)} - \text{AT (305 cm)}}{\text{(distance in m)}}$$

The more negative the number; the more stable the air.

The more stable the air, the more likely particles are to be suspended.

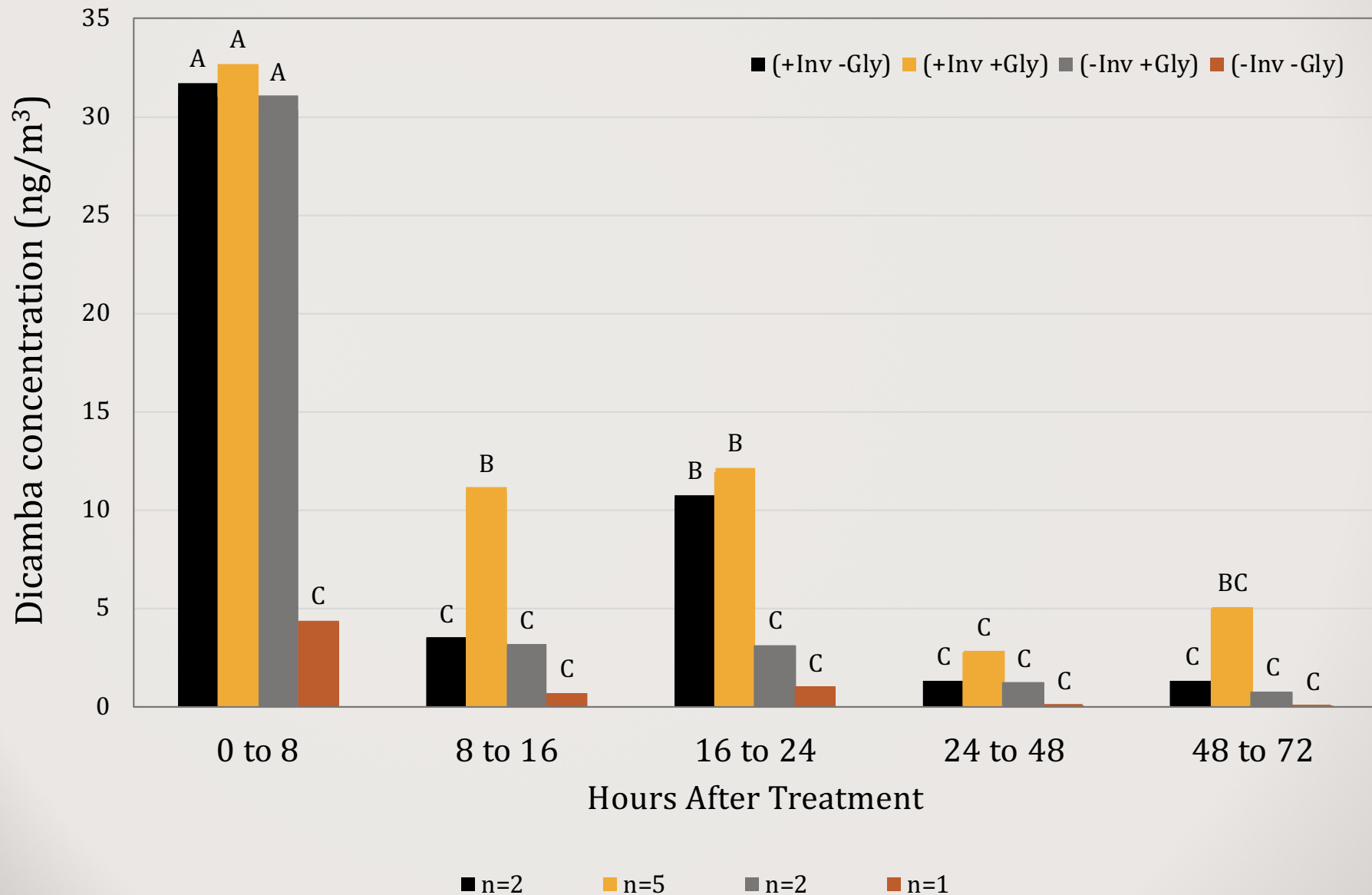
The impact of inversions on dicamba in the air?

	Minimum Lapse Rate	Maximum Air Temperature	Maximum Wind Speed
Dicamba concentration	-0.33319	-0.72031	-0.72265
P-value	p = 0.0021	p<0.0001	p<0.0001

Spearman's Correlation:

- Dicamba concentrations at 8-hour intervals following application (regardless of time of application)
- Minimum lapse rate within the 8-hour interval
- Maximum wind speed within the 8-hour interval
- Maximum air temperature within the 8-hour interval

Summary of Evening Applications



Preliminary Conclusions and Future Work

- Both Xtendimax and Engenia were detected up to 96 hours after application.
- Highest dicamba concentrations were detected during the evening following application.
- Dicamba was also detected in the afternoon following evening application at an average level of 10.8 ng/m³. This level is likely high enough to cause dicamba injury if moved off-target.
- Dicamba concentrations in the air appear to be influenced by atmospheric stability.
- Similar experiments will be conducted in 2018; more analyses of weather factors surrounding the dicamba applications.



Questions?

