2,4,-D, DICAMBA, AND HERBICIDE DRIFT

Diagnosing Herbicide Drift in the Field

Results of Herbicide Tissue Analysis

What We Have Learned and Thoughts Going Forward

INJURY SYMPTOMS WITH GROWTH REGULATORS

- Twisted and downward cupping of leaves

- Narrow strap-like leaves on new growth

- **Root uptake is more damaging**

SYMPTOMS ASSOCIATED WITH PHENOXY CHEMICAL HERBICIDES

SYMTPOMS ASSOCIATED WITH GROWTH REGULATORS

- Root uptake of dicamba causes leaves to cup upward instead of downward

HERBICIDE INJURY LOOK-ALIKES

- Mites, insects, diseases
- Adverse weather
- Soil compaction
- Drought
- Root stress

HERBICIDE INJURY LOOK-ALIKES

- Improper soil pH
- Misapplied fertilizers
- Genetic mutations
- De-icing salts

DIAGNOSING HERBICIDE INJURY

- **Know symptoms** of herbicides on specific plants

- **Mode of action, fate in soils, and dosage applied**
  - Dicamba can be taken up by tree roots in treated areas
  - Know what other herbicides were applied

- **Timing**
  - Damage usually occurs within days after exposure
  - Symptoms may develop several weeks after exposure
  - Later, if tree roots grow into a treated site

DIAGNOSING HERBICIDE INJURY

- **Patterns on adjacent plants**
  - Look for similar damage patterns
  - Look for damage on other different plants
- **Location**
  - Injured plants relative to herbicide application
  - **Soil sterilants will move in direction of water flow**
  - Weather at application time

DIAGNOSING HERBICIDE INJURY

- **Recovery**
  - Affected by overall plant vitality
  - Amount of herbicide received
  - Type of herbicide
  - Growing conditions after contact

- **New growth usually will appear normal**
- **Symptoms may persist for 2 to 3 seasons**
- **Heavy dose may kill plants**

DIAGNOSING HERBICIDE INJURY

- Contact herbicides cause leaf spotting
- Total tissue death is uncommon
- Plants absorbing soil sterilant may die
- Timing of exposure is important
- **Exposure late in year is not as injurious**

PLANTS SENSITIVE TO GROWTH REGULATORS

- Apple
- Forsythia
- Horse chestnut
- Redbud
- Sycamore
- Box elder
- Grape
- Norway maple
- Rose
- Dogwood
- Honeylocust
- Petunia
- Siberian elm

PLANTS EXTREMELY SENSITIVE TO HERBICIDES

- **Extremely Sensitive**
- Grapes
- Snap bean
- Peach
- Oaks
- Lima bean
- Soybean
- Elderberry
- Viburnum
- Southern Pea
- Tobacco
- Dogwood

PLANTS VERY AND MODERATELY SENSITIVE TO HERBICIDES

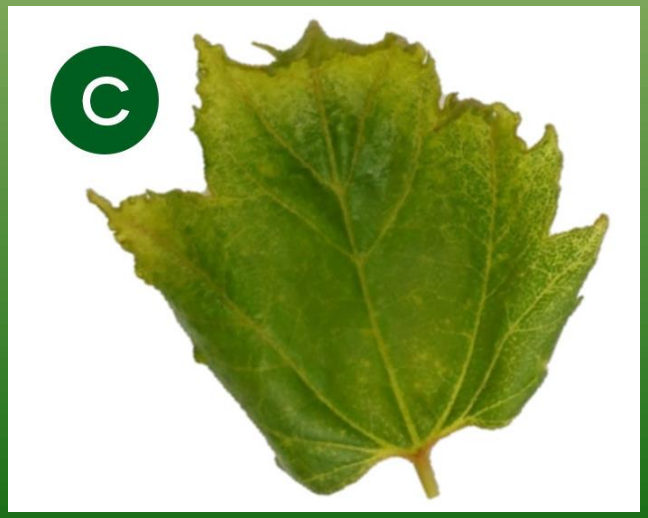
- **Very Sensitive**
- Cotton
- Tomato
- Pumpkin
- Pepper
- Watermelon
- Squash

- **Moderately Sensitive**
- Cantaloupe
- Apple
- Redbud
- Cucumber
- Maple
- Rose

PLANTS WITH LOW SENSITIVITY TO HERBICIDES

- **Low Sensitivity**
- Peanut
- Cabbage
- Mustard
- Walnut
- Raspberry
- Sweetgum
- Hydrangea
- Broccoli
- Kale
- Turnip
- Pecan
- Strawberry
- Crabapple

Figure 3: Response of peach **(A), pin oak (B), maple (C), elm (D), and grape (E)** to 1/20th of the standard use rate of dicamba (0.025 lb ae/A) or dicamba + glyphosate (0.025 + 0.05 lb ae/A). **This rate is representative of what can occur during a physical drift event.**



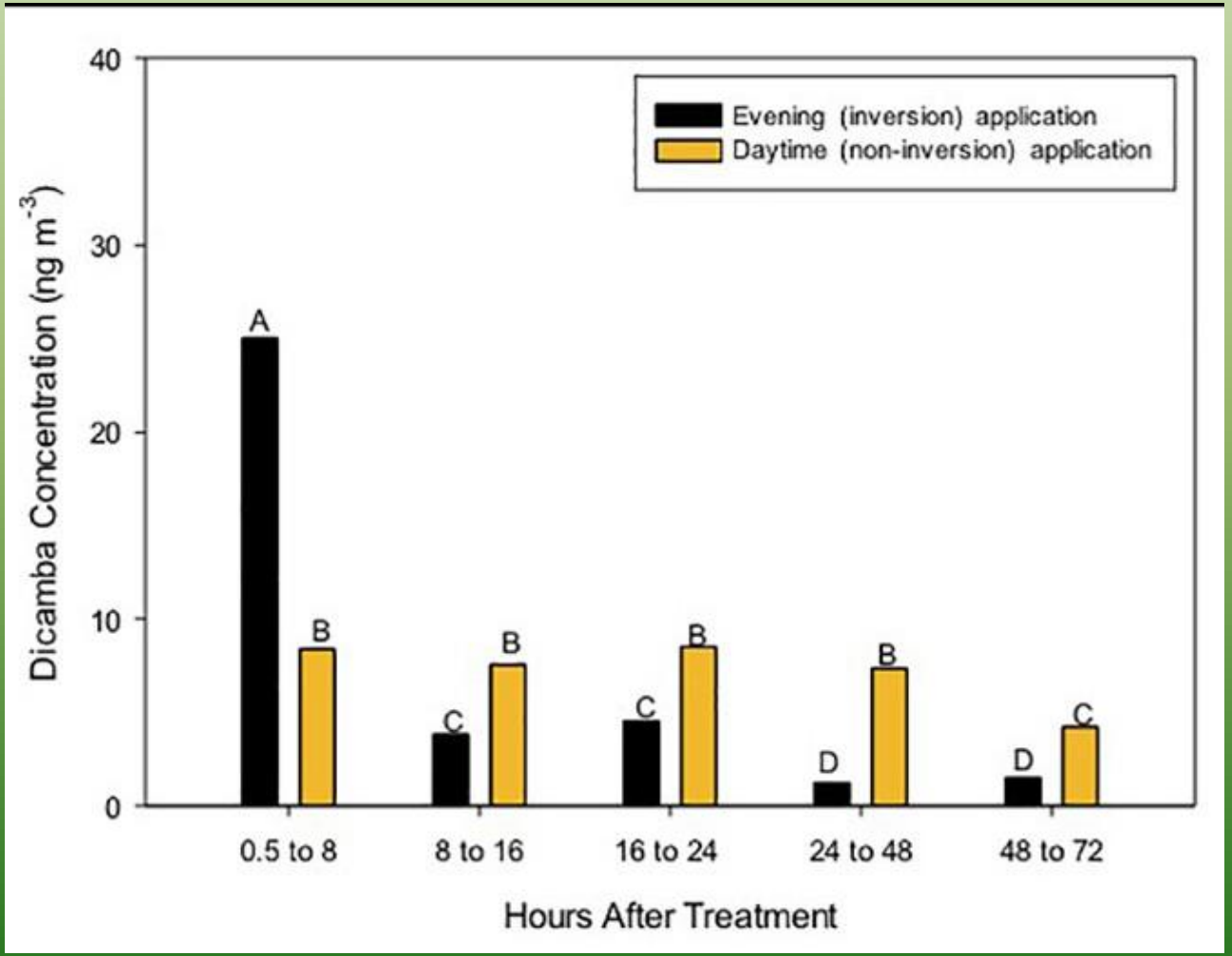
FIVE THINGS WE HAVE LEARNED ABOUT DICAMBA

Bradley and Bish: University of Missouri –Extension

9 April 2019

- **1. Dicamba can be detected in air following treatment**
  - Nothing new, but dicamba products are volatile
  - **Questions remaining are:**
    - How much volatility results in off-target injury?
    - Can we do anything to minimize off-target injury?
  - Highest concentrations occur in first 8 hours post application and up to 72 hours
  - Higher concentrations in evening hours during stable conditions favoring temperature inversions

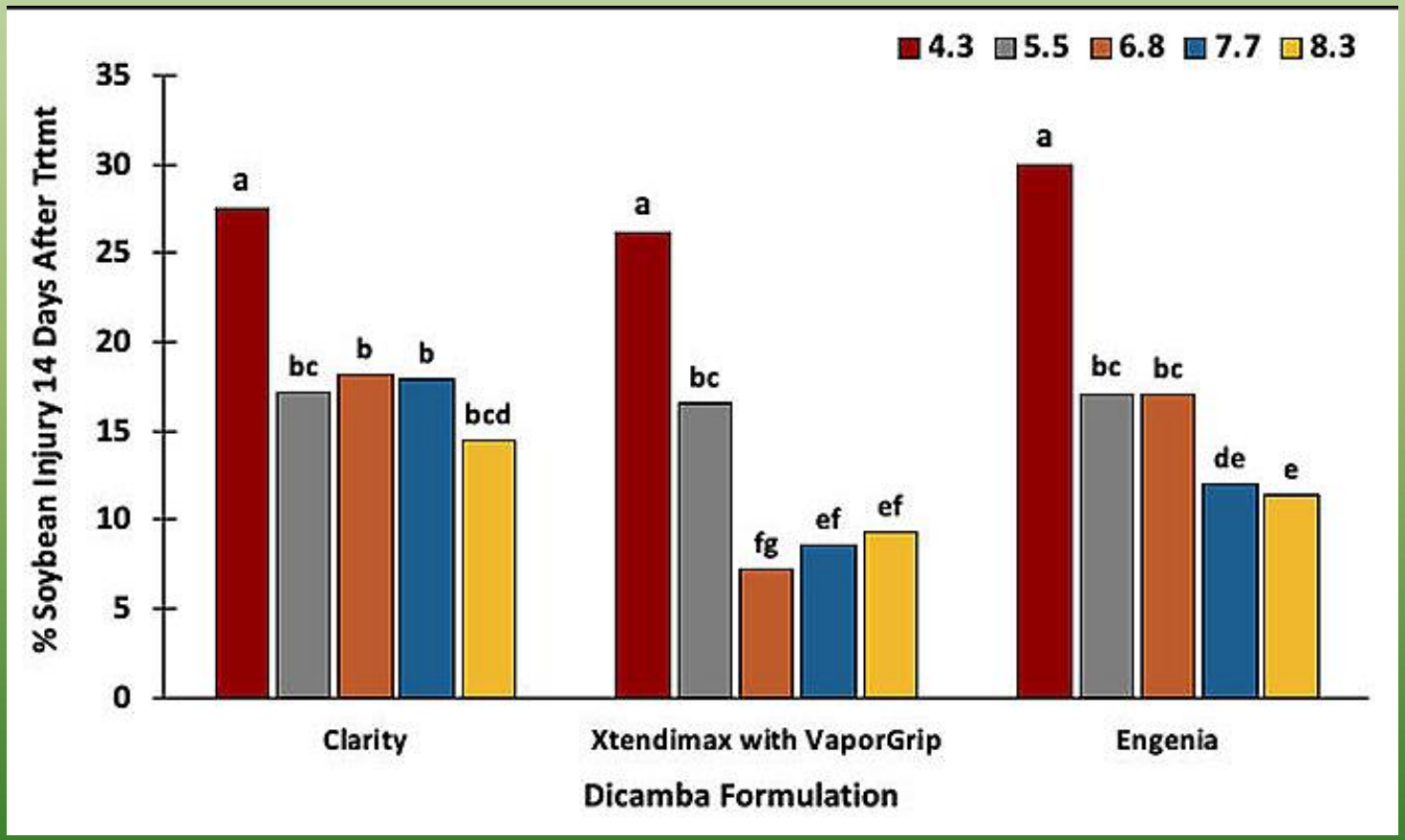
Figure 1: Dicamba air concentrations following application during evening, inverted air temperature conditions (**black bars**) and daytime, non-inverted air temperatures (**gold bars**).



- **2. Addition of glyphosate and spray tank pH matters**
  - Lowers pH of spray solution
  - With low pH, dicamba may dissociate to acid form which is the most volatile form
  - Avoid a spray mix of less than 5

- **3. Soil pH matters**
  - The lower the soil pH the more volatility occurs with dicamba formulations
  - May be an important piece of the over all puzzle

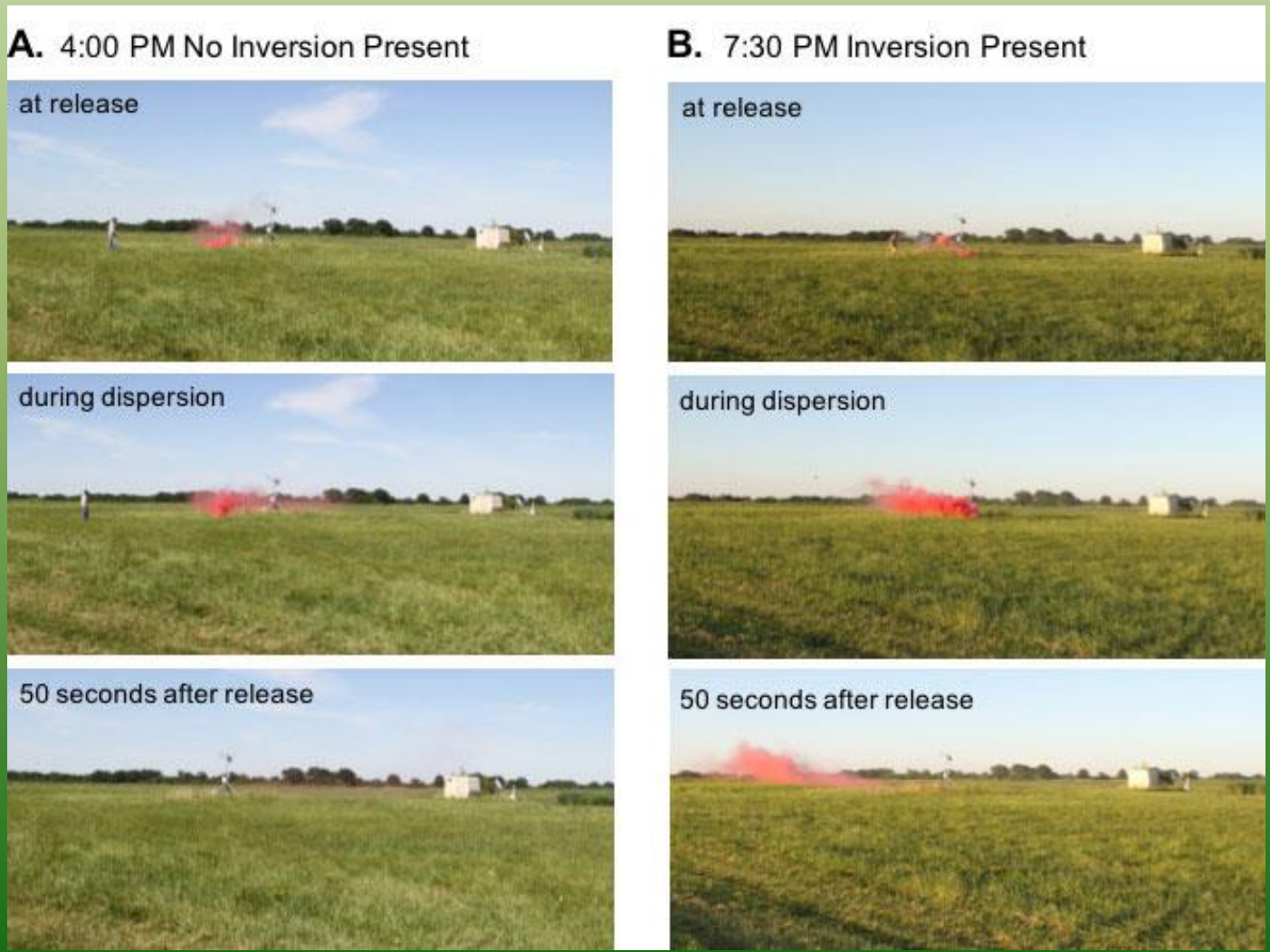
Figure 2: Influence of soil pH and dicamba formulation on soybean injury as a result of volatility. Results are combined across two experiments conducted in 2018. Bars followed by the same letter are not different.



- **4. Temperature inversions are common**
  - **Can occur from April to July**
  - **Begin forming before sunset**
    - April: 5:00 and 6:30 pm
    - May : 5:30 and 6:50 pm
    - June: 6:00 and 7:00 pm
    - July: 6:00 and 8:00 pm
  - Field surrounding influence time of inversions
    - Form more quickly and earlier in areas where wind is obstructed
  - Cool air will gravitate to the lowest point in a field
  - Dicamba may move with cool-stable air masses
  - Dicamba can be detected in air following applications during inverted air temperatures
  - Smoke bombs are good indicators of inversions

Figure 3: Obstructions to wind can result in inversions forming more rapidly. In this example the **star** marks the location of the inversion-monitoring weather station. A tree row 125' to the south of the weather station provides obstructions to the prevailing southern wind. Inversions typically form earlier at this location compared to other sites.

Figure 5 Smoke bombs can serve as visual indicators of inverted air temperatures. When temperatures are not inverted **(A)**, the smoke bomb dissipates. When air temperatures are inverted **(B)**, the red smoke lingers and suspended particles can be moved by wind. The weather station monitoring the air temperatures is in the middle of each photo as a height reference; it is 120" in height.



- **5. Burndown applications of dicamba products can still cause problems**
  - These herbicides are **less likely** to move off-target and cause injury when applied as a burndown in April and May
  - In 2018, more calls and complaints were received in April and May injury to specialty crops and trees than at any other time during the season
  - Damage appeared to coincide with bud break and leaf unfolding (i.e. April and May) for many tree species