

Identification of Soybean Lines with Differential Sensitivity to Dicamba

Matthew Osterholt¹, Scott McAdams¹, Katy Rainey¹, Caio Canella Vieira², Pengyin Chen², Bryan Young¹
 Purdue University, West Lafayette, IN¹
 University of Missouri – Fisher Delta Research Center, Portageville, MO²

Introduction

- Of the 178 dicamba related drift events that were reported to the Office of the Indiana State Chemist in 2019, over 90% involved off-target movement to dicamba-sensitive soybean.¹
- Research conducted at the University of Missouri – Delta Center Soybean Breeding program in 2019 evaluated 230 soybean lines and identified differential sensitivity to dicamba among conventional soybean lines.²
- Identifying soybean lines that have decreased sensitivity to dicamba could offer a unique opportunity to develop soybean varieties that can minimize the impact of off-target dicamba movement and further elucidate the mode of action for dicamba.

Hypothesis

Soybean lines that purportedly have low and high sensitivity to dicamba will have different phenotypic and biochemical response to dicamba.

Objectives

1. Determine if there are phenotypic differences between soybean lines that purportedly have different sensitivity to dicamba by measuring visual injury, percent of injured nodes, and percent nodes reduction.
2. Quantify ABA concentrations as a biochemical measure of the differential response to dicamba in the soybean lines.

Experimental Design

- A field study was conducted by planting 9 different soybean lines in 3 m plots in 2020.
- Two-factor factorial in a split plot design with four replications within blocks
 - ☐ Dicamba rate (0 and 5.6 g ae ha⁻¹)
 - ☐ Conventional soybean lines
 - ❖ 9 individual lines
- Dicamba applied to soybeans utilizing a CO₂-pressurized backpack sprayer calibrated to deliver 115 ha⁻¹ at 190 kPa.
- Dicamba was applied when the soybean were at V3 stage.

| | Low Sensitivity | High Sensitivity |
|-----------|-----------------|------------------|
| S17-1980 | S17-2615 | |
| S16-12774 | PR17-510 | |
| S17-5672 | S17-2625 | |
| S14-1855 | S17-3404 | |
| S09-13608 | | |

Data Collection and Analysis

- Visual injury, plant height, number of injured nodes, and total nodes were recorded at 28 DAT for all soybean lines.
- The apical meristem was sampled at 6, 24, and 48 hours after treatment (HAT) for ABA quantification for one soybean line purportedly to be less sensitive (S16-12774) and one line purportedly to more sensitive to dicamba (S17-2625).
- ANOVA was conducted using PROC GLIMMIX in SAS 9.4
 - ☐ Mean separation via Tukey's HSD ($\alpha=0.05$)

Results

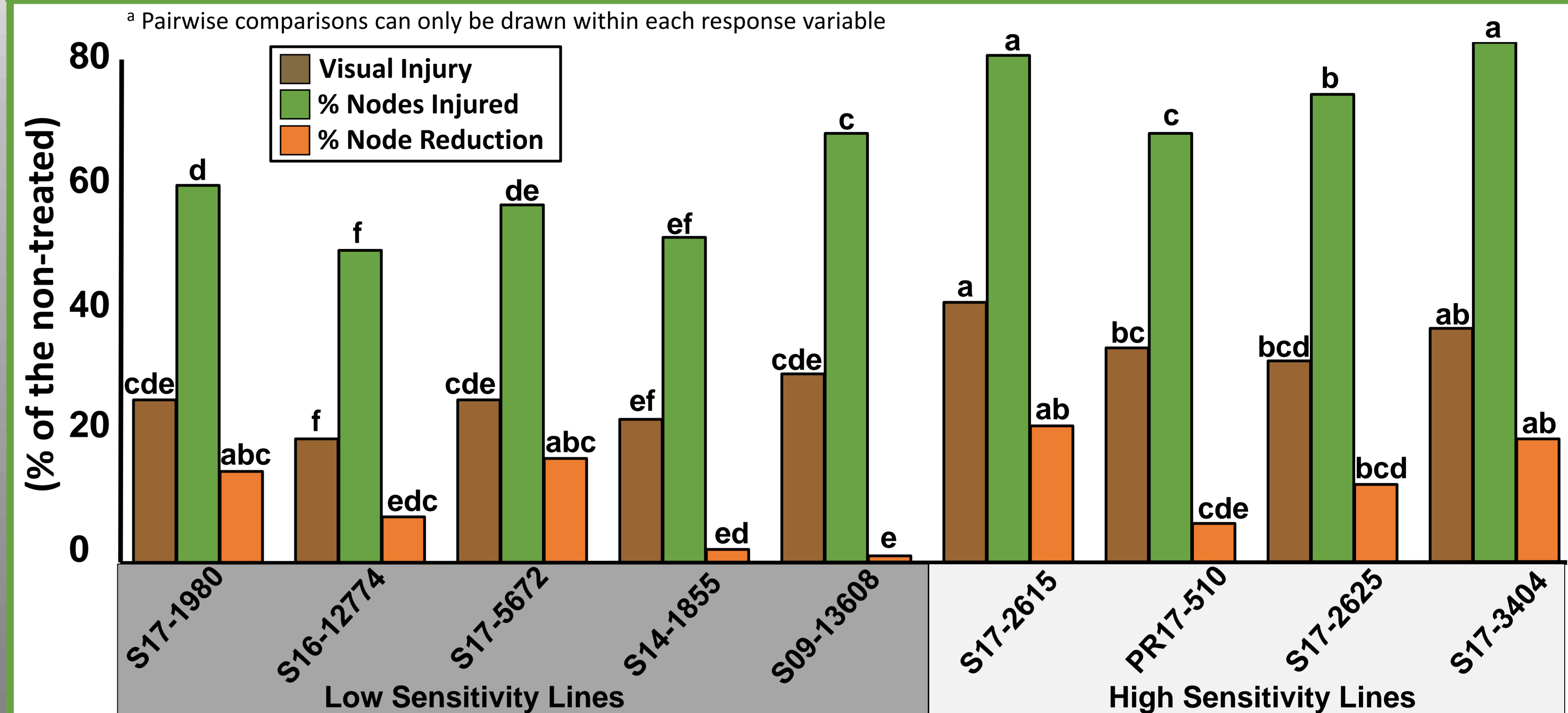


Figure 1. Response of soybean lines to dicamba.^a

Table 2. ABA concentration for soybean lines S16-12774 and S17-2625 at the apical meristem when treated with dicamba.^a

| Soybean line | 6 HAT | 24 HAT | 48 HAT |
|-----------------------------|---------------------------------|--------|--------|
| | ng g fresh weight ⁻¹ | | |
| S16-12774 (low sensitivity) | 550 a | 643 a | 353 b |
| S17-2625 (high sensitivity) | 615 a | 518 a | 660 a |



Photo 1. S17-2615 soybean injury with the left soybean being non-treated and the right soybean treated with 5.6 g ae ha⁻¹.



Photo 2. S14-1855 soybean injury with the left soybean being non-treated and the right soybean treated with 5.6 g ae ha⁻¹.

Summary

- Visual injury, percent of total nodes injured, and percent node reduction were lower in the S16-12774 and S14-1855 soybean lines in comparison to the S17-2615 and S17-3404 lines (Figure 1) (Photos 1 & 2).
- ABA concentration was reduced at the apical meristem at 48 HAT in comparison to 6 and 24 HAT for the S16-12774 soybean line (Table 2).
- ABA concentration did not change over time for the S17-2625 soybean line (Table 2).

Conclusions

- The S16-12774 and S14-1855 soybean lines demonstrated decreased sensitivity to dicamba in comparison to the S17-2615 and S17-3404 lines.
- The reduction in ABA concentration at the apical meristem for the S16-12774 soybean line is biochemical validation of the differential phenotypic response

Future Research

- Greenhouse experiments will be conducted to:
- ☐ Determine the mechanism for decreased sensitivity
 - ☐ Further characterize the role of ABA on the phytotoxic response in soybean from dicamba

References

- 1 Scott D (2019) Dicamba 2019 Off-Target Movement Response & Plans for 2020 (PowerPoint Slides). https://www.oisc.purdue.edu/pesticide/iprb/iprb_159_2019_dicamba_plans_2020_DRAFT.pdf. Accessed 2/12/2020
- 2 (Caio Canella Vieira, University of Missouri – Fisher Delta Research Center, graduate research assistant, personal communication