

# Use of Dicamba and Glufosinate to Control Common Pervasive Weed Species

Jackson W. Alsdorf, Eric A.L. Jones, Diego J. Contreras, Charles W. Cahoon, Ramon G. Leon, Wesley J. Everman

Department of Crop and Soil Sciences, North Carolina State University, Raleigh, North Carolina

NC STATE  
UNIVERSITY

## Introduction

- Common ragweed, Palmer amaranth, sicklepod, and goosegrass are pervasive row crop weeds in the Southeast United States (Webster and Nichols 2012)
- Common ragweed has evolved resistance to four herbicide groups (2, 5, 9, and 14)
- Palmer amaranth has evolved resistance to nine herbicide groups; (2, 3, 4, 5, 9, 10, 14, 15, 27)
- No sicklepod population has evolved resistance but the species can be difficult to control with herbicides (Bruff and Shaw 1992; Leon et al. 2016)
- Goosegrass has evolved resistance to eight herbicide groups (1, 2, 3, 5, 9, 10, 14, 22)
- Dicamba is a slow acting, systemic herbicide while glufosinate is a fast acting, contact herbicide (Grossmann 2009; Takano et al. 2019)
  - Mixtures including these two herbicides can cause control antagonism (Besançon et al. 2018; Burke et al. 2005)
- Dicamba and glufosinate have different modes of action so knowledge of the interaction between these herbicides is crucial for effective weed management

## Objective and hypothesis

- The research objective was to determine the control of pervasive weeds with dicamba and glufosinate applied alone, mixed, and sequentially
- The hypothesis of the study was dicamba+glufosinate would provide additive control on all species but control with sequential applications could increase/decrease depending on the order of the herbicides applied

## Materials and Methods

- Field studies were conducted at Kinston and Rocky Mount, North Carolina in 2019 and 2021
- Randomized complete block design with four replications
  - Plots: 3.0 by 4.5 m; remained fallow
- Dicamba (560 g ai ha<sup>-1</sup>) treatments were applied with TeeJet 11002 spray nozzles
- Glufosinate (590 g ai ha<sup>-1</sup>) treatments were applied with TeeJet XR 11002-VS spray nozzles
- Dicamba+glufosinate treatments were applied with TeeJet 11002 spray nozzles
- Plants were treated at 5 and 15 cm in height with a CO<sub>2</sub>-powered backpack sprayer at an output of 140 L ha<sup>-1</sup>
- The sequential herbicide applications were made one week after the initial herbicide application.
- Control was visually estimated 28 days after in the initial herbicide application
  - 0% = no control and 100% = complete control
- Control data were analyzed using the GLIMMIX procedure in Statistical Analysis Software 9.4 (SAS, Cary, North Carolina)
  - Means were separated using Tukey's HSD (0.05)
  - Year and location were considered random effects (Blouin et al. 2011)
- Dicamba+glufosinate treatments were analyzed for antagonism (Colby, 1967)
- Colby's equation:  $E = (X + Y) - (XY) / 100$ 
  - Where E = expected control of two herbicides applied in a mixture and X,Y = control of herbicide X,Y when applied alone

Table 1. Dicamba and glufosinate treatments applied to giant ragweed, goosegrass, sicklepod, and palmer amaranth. Dicamba only treatments not applied to goosegrass.

Initial	Sequential	Treatment code
No initial treatment	Dicamba	N fb D
No initial treatment	Glufosinate	N fb G
No initial treatment	Dicamba + glufosinate	N fb DG
Dicamba	No sequential treatment	D
Dicamba	Dicamba	D fb D
Dicamba	Glufosinate	D fb G
Dicamba	Dicamba + glufosinate	D fb DG
Glufosinate	No sequential treatment	G
Glufosinate	Dicamba	G fb D
Glufosinate	Glufosinate	G fb G
Glufosinate	Dicamba + glufosinate	G fb DG
Dicamba + glufosinate	No sequential treatment	DG
Dicamba + glufosinate	Dicamba	DG fb D
Dicamba + glufosinate	Glufosinate	DG fb G
Dicamba + glufosinate	Dicamba + glufosinate	DG fb DG

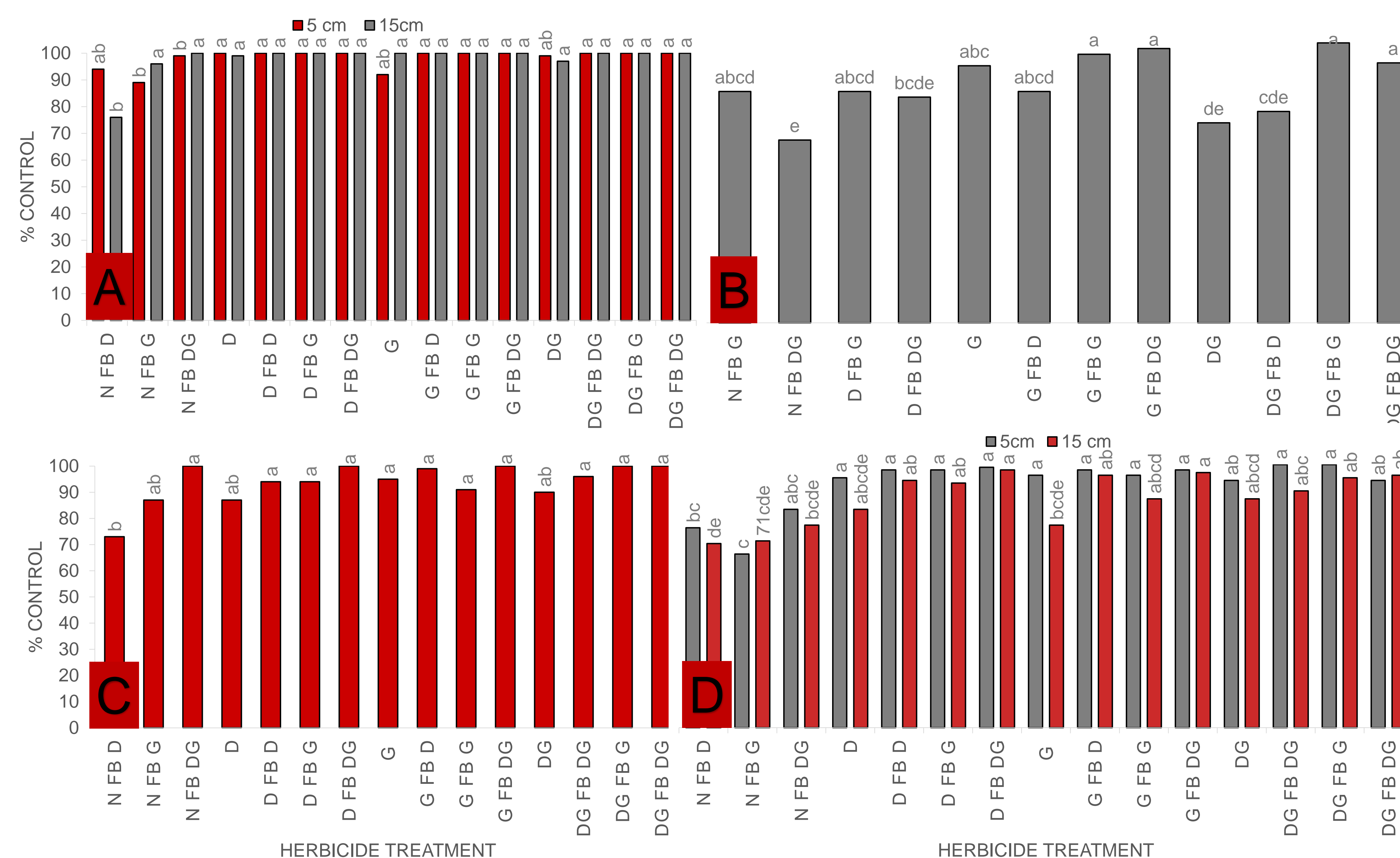


Figure 1: Control of (A) common ragweed, (B) goosegrass, (C) sicklepod, (D) and Palmer amaranth 28 days after treatment. Bars with similar letters are statistically similar. Giant ragweed and Palmer amaranth are shown at 5 and 15cm while sicklepod and goosegrass results were averaged between both heights.

## Results

### Common ragweed

- Treatment ( $P < 0.0001$ ), size ( $P = 0.69$ ), and treatment x size ( $P = 0.0005$ ); data analyzed by the interaction
- The single herbicide treatments controlled the 5 and 15 cm plants similarly, respectively (Figure 1A)
- All sequential herbicide treatments effectively controlled 5 and 15 cm plants (Figure 1A)
- No initial treatment fb glufosinate controlled the 5 cm plants approximately 11% less than all sequential herbicide treatments (Figure 1A).
- No initial treatment fb dicamba controlled 15 cm plants approximately 24% less than all sequential herbicide treatments (Figure 1A).
- Dicamba+glufosinate additively controlled 5 and 15 cm plants (Data not shown)

### Goosegrass

- Treatment ( $P < 0.0001$ ), size ( $P = 0.53$ ), and treatment x size ( $P = 0.12$ ); data averaged over size
- Control was 20 and 17% greater with glufosinate and no initial treatment fb glufosinate compared to dicamba + glufosinate and no initial treatment fb dicamba + glufosinate (Figure 1B)
- Sequential herbicide treatments provided similar control with the exception that dicamba fb dicamba + glufosinate control was 16% less than glufosinate fb dicamba + glufosinate (Figure 1B)
- Glufosinate fb dicamba + glufosinate and glufosinate fb glufosinate provided 18-31% more control compared to dicamba + glufosinate and no initial treatment fb dicamba + glufosinate (Figure 1B)
- Dicamba+glufosinate treatments provided antagonistic control (Figure 1B)

### Sicklepod

- Treatment ( $P < 0.0001$ ), size ( $P = 0.06$ ), and treatment size ( $P = 0.65$ ); data averaged over size
- Most single and sequential herbicide treatments provided similar control (Figure 1C)
- No initial treatment fb dicamba controlled plants 21 to 24% less than most of the single and all sequential herbicide treatments (Figure 1C)
- Dicamba+glufosinate additively controlled plants (Data not shown)

### Palmer amaranth

- Treatment ( $P < 0.0001$ ), size ( $P = 0.02$ ); data analyzed by the interaction
- Dicamba, glufosinate, and dicamba + glufosinate controlled the 5 cm plants, similarly (Figure 1D)
- No initial treatment fb dicamba and no initial treatment fb glufosinate provided 19 to 30% less control on 5 cm Palmer amaranth compared to dicamba and glufosinate (Figure 1D)
- All sequential herbicide treatments completely controlled the 5 and 15 cm plants (Figure 1D)
- The single herbicide treatments controlled 15 cm plants, similarly but control was lower compared to when these treatments were applied to 5 cm plants (Figure 1D)
- Dicamba + glufosinate additively controlled 5 and 15 cm plants (Data not shown)

## Conclusions

- Herbicide treatment order does not affect broadleaf weed control, but greater grass control is obtained when glufosinate is applied first
- Dicamba+glufosinate additively controlled broadleaves and was antagonistic towards goosegrass
  - This is not a legal tank mix and should not be recommended as an application option

## Future Research

- Determine the interaction of dicamba and glufosinate on other pervasive weed species
- Conduct the research in a corn, cotton, and soybean crop

## Acknowledgements

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