Investigations of the Sensitivity of Ornamental, Fruit, and Nut Plant Species to 2,4-D and Dicamba

Brian Dintelmann

Advisor: Dr. Kevin Bradley

Mizzou weed science

Outline

- Introduction
- 2017 and 2018 Studies
  - Objectives
  - Materials and Methods
  - Results
- Conclusions

Mizzou weed science

Introduction

- Herbicide resistant weeds
- Release of dicamba and 2,4-D tolerant crops
- Off-target movement of 2,4-D and dicamba

Off-target Movement

The movement of a herbicide spray away from the intended target to an unintended target. It can happen during application, hours, or days after an application is made.

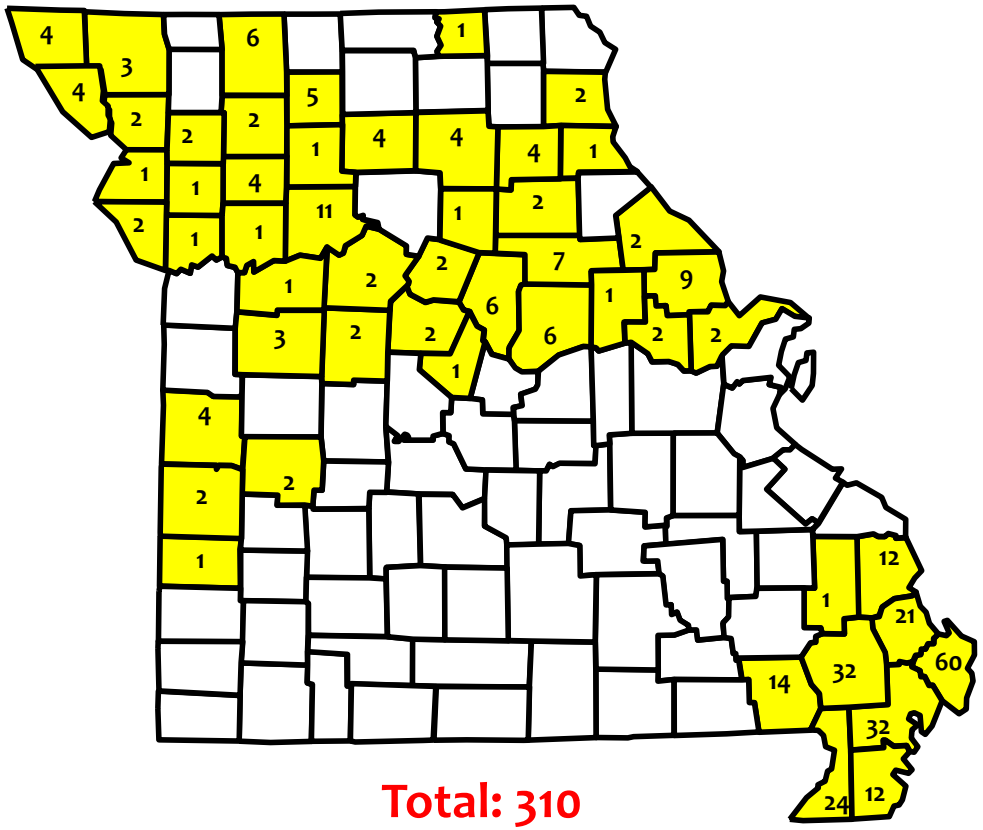
- Primary Drift
  - Physical spray particles
  - Influenced by wind, and sprayer setup.
- Secondary Drift
  - Vapors of herbicide
  - Influenced by herbicide formulation, temperature, RH, wind, & inversions

Mizzou weed science

Concern for nearby specialty crop growers

Concern for general public

Official Dicamba-related Injury Reports to MO Dept. of Agriculture (2017)



Total: 310

Crops Damaged:

108,758 acres of soybeans
18,904 tomato plants
758 acres of peaches
132 acres of vineyards
130 acres rice
122 acres of watermelons
35 acres of alfalfa
24 acres organic vegetables
15 acres of pecan trees
12 acres of apple trees
11 commercial gardens
10 acres of cantaloupes
2 acres of pumpkins
900 mums
40 residential properties (gardens/trees/shrubs)

Mizzou weed science

Objectives

- To determine the **sensitivity** of ornamental, fruit, and woody and species to 2,4-D and dicamba

- To document differences in 2,4-D and dicamba s**ymptomology**

Mizzou weed science


Plant Species
• Apple
• Peach
• Norton Grape
• Black Walnut
• Pecan
• Raspberry
• Strawberry
• Elderberry
• Dogwood
• Red Maple
• Sweetgum
• Pin Oak
• Crabapple
• American Elm
• Redbud
• Hydrangea
• Viburnum
• Rose

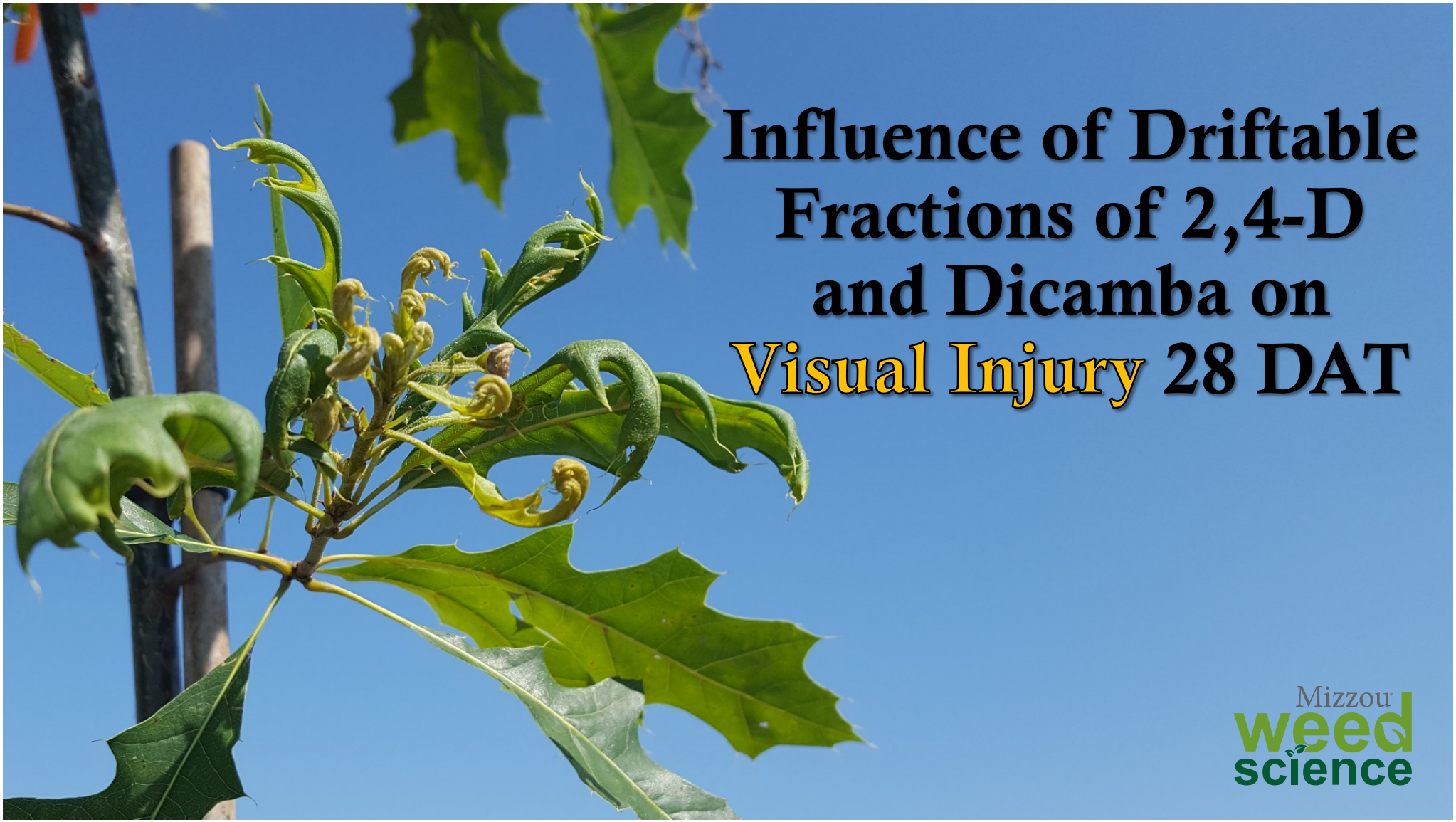
Active Ingredient	1X Rate (kg ae/A)	Fraction of 1X Rate
2,4-D Choline (Enlist One)	1.09	1/2x 1/20x 1/200x
2,4-D Choline + Glyphosate (Enlist Duo)	1.09 + 1.1	1/2x 1/20x 1/200x
Dicamba (DGA+VaporGrip) (Xtendimax)	0.56	1/2x 1/20x 1/200x
Dicamba (DGA+VaporGrip) + Glyphosate (Xtendimax + Roundup)	0.56 + 1.1	1/2x 1/20x 1/200x

Materials and Methods

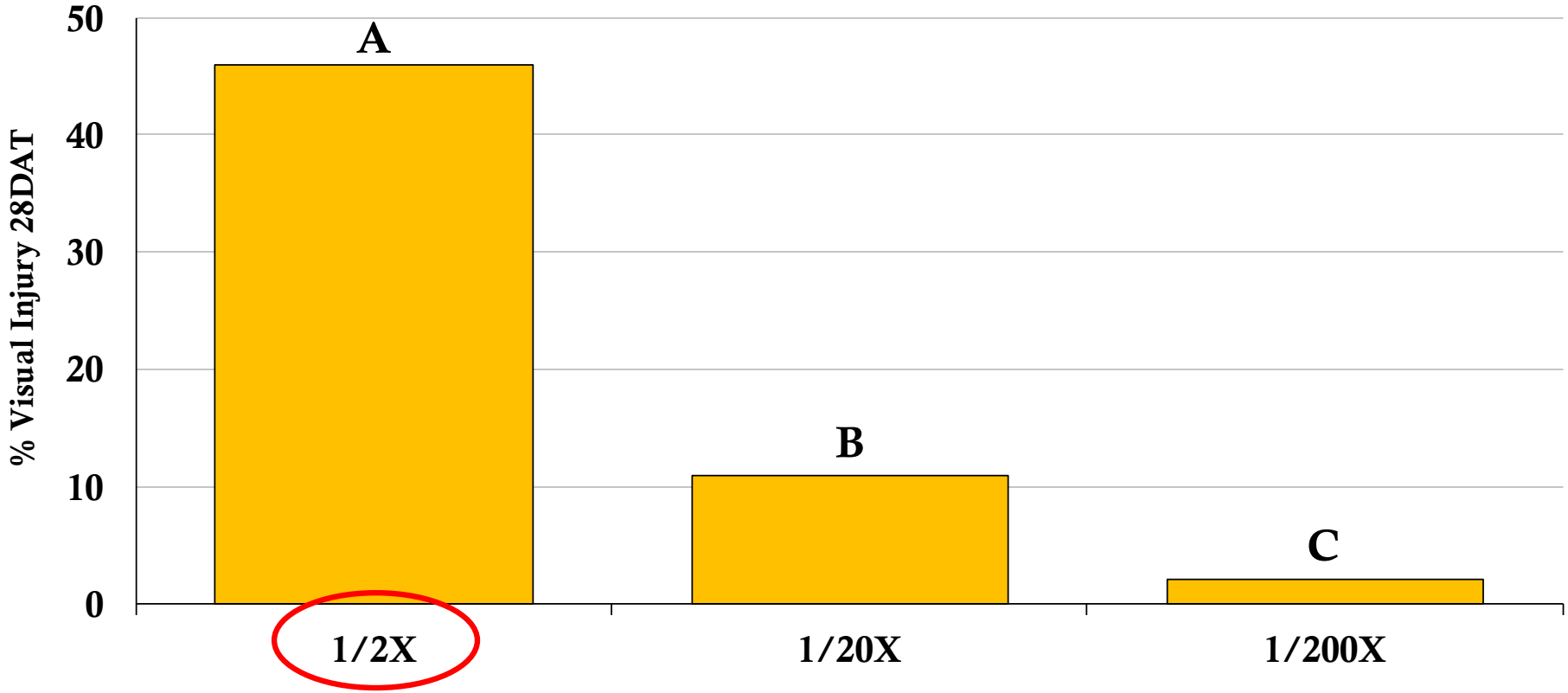
- 18 perennial species were established in 10-20 L pots in New Franklin, MO in spring of 2017 and 2018.
- The experimental design was a split-plot with five replications.
- Herbicide applications were made to plants on June 8, 2017 and June 12, 2018 with a CO_2-powered backpack sprayer delivering 140 L/ha at 138 kPa.

Materials and Methods

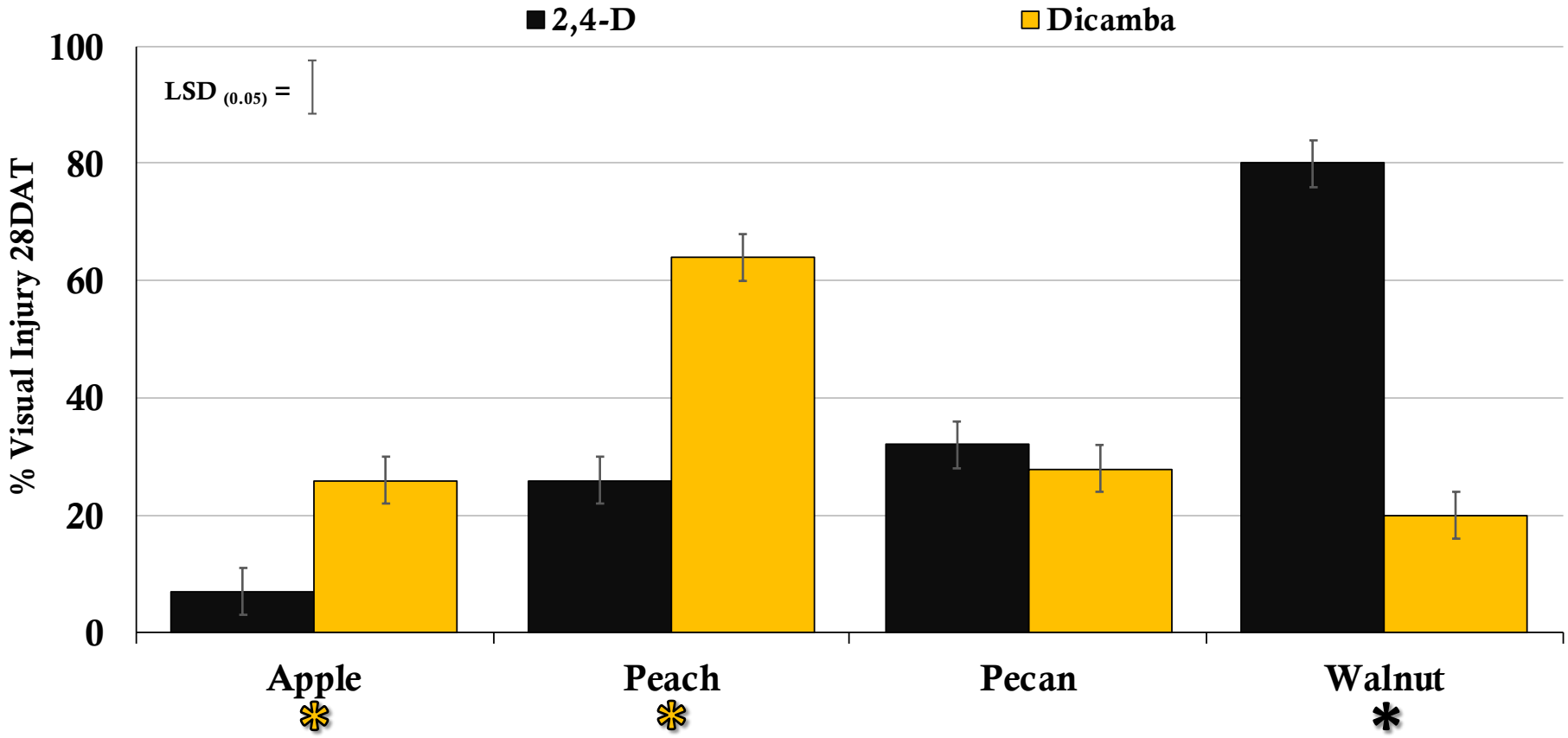
- Visual injury was assessed at regular time intervals following treatment.
- Tree trunk diameter and shoot length were also measured.
- Data was analyzed in SAS using the PROC GLIMMIX procedure. Means were separated using Fisher's Protected LSD, $P \leq 0.05$.


Influence of Driftable Fractions of 2,4-D and Dicamba on Visual Injury 28 DAT
Mizzou
weed
science

Influence of Herbicide Rates on Ornamental, Fruit, and Woody Plant Species



1/2X Rates of Dicamba vs. 2,4-D on Fruit and Nut Tree Species



Dicamba Injury on Apple

Dicamba vs. 2,4-D on Peach Trees

1/20X

Dicamba

2,4-D

1/2X

Dicamba

2,4-D

Differences in Symptomology on Walnut

Dicamba Injury

2,4-D Injury

Mizzou weed science

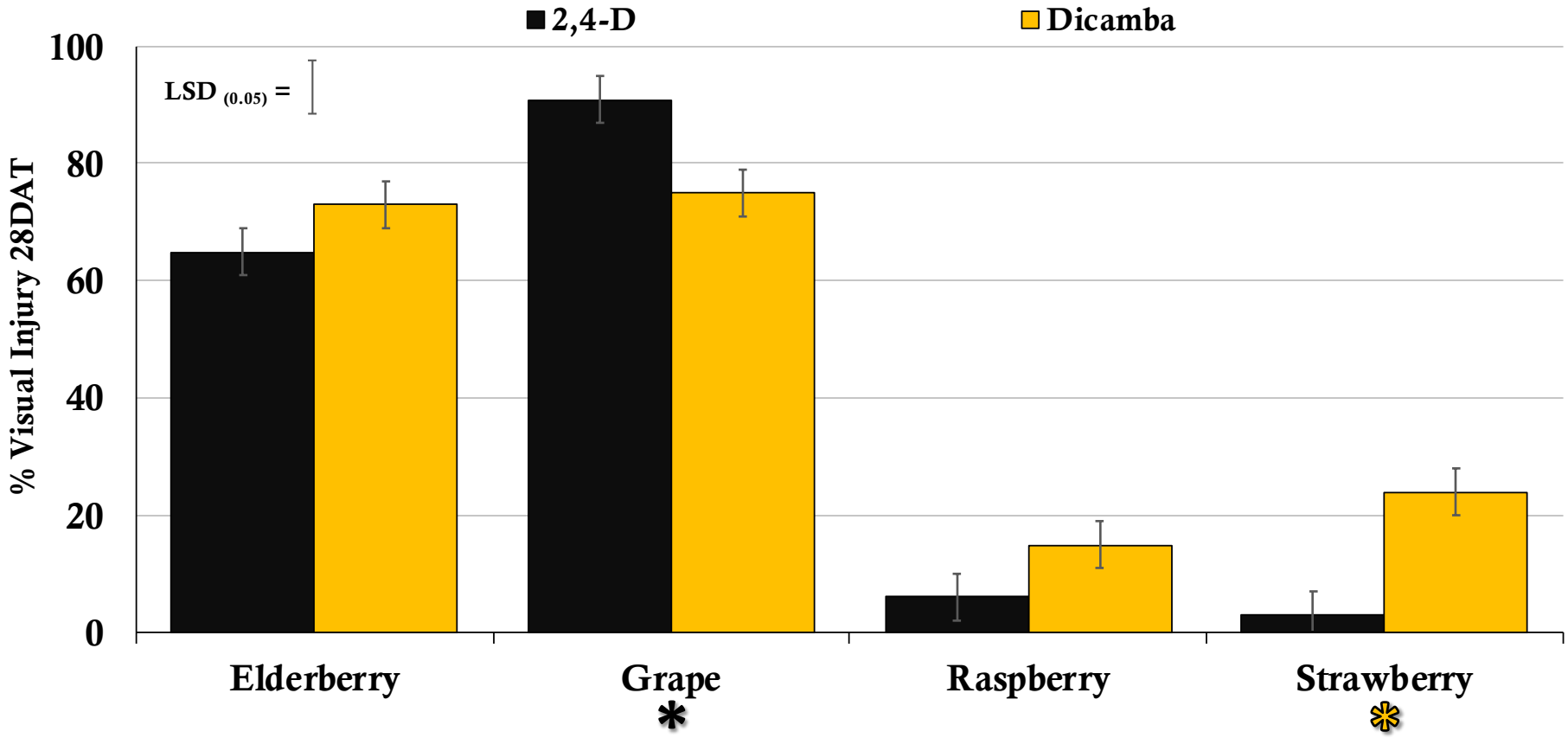
Dicamba Injury on Pecan

Mizzou weed science

2,4-D Injury on Pecan

Mizzou weed science

1/2X Rates of Dicamba vs. 2,4-D on Berry Species



Influence of 1/20x 2,4-D vs. Dicamba on Norton Grape

Non-Treated

2,4-D

Dicamba

Mizzou weed science

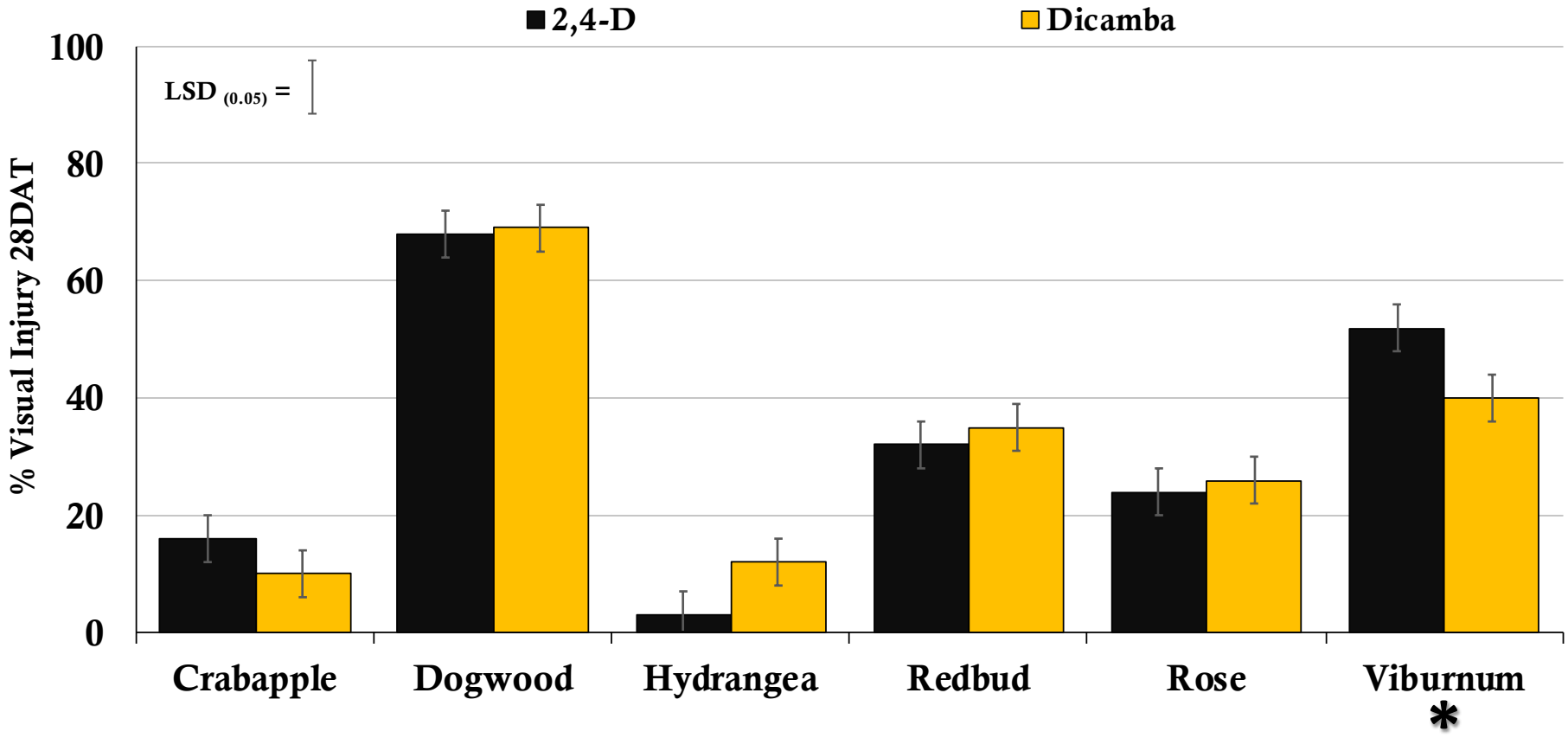
Differences in Symptomology on Grapes

2,4-D Injury

Dicamba Injury

Mizzou weed science

1/2X Rates of Dicamba vs. 2,4-D on Ornamental Species



Dicamba Injury on Dogwood

Mizzou weed science

2,4-D Injury on Dogwood

Mizzou weed science

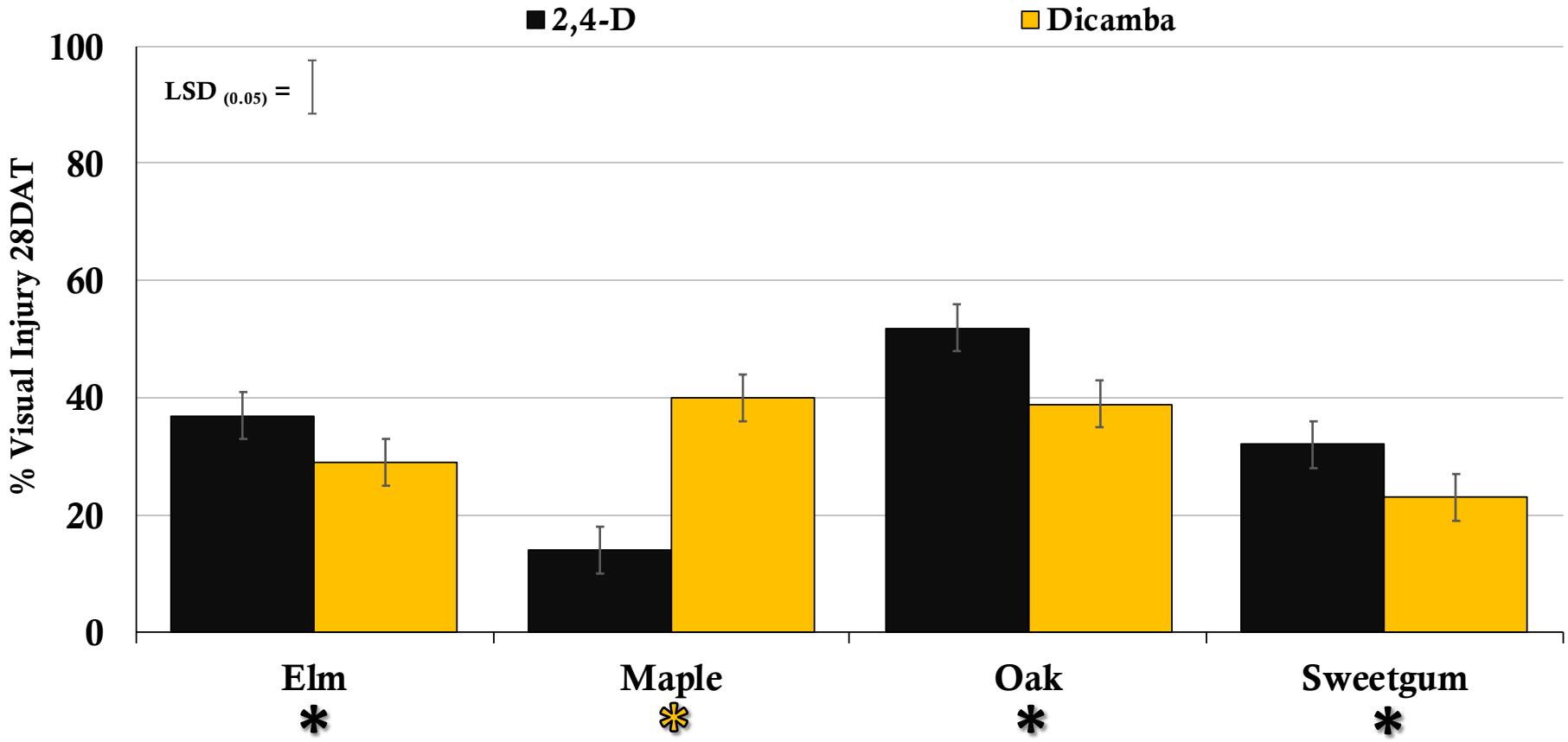
2,4-D Injury on Redbud

Mizzou weed science

Dicamba Injury on Redbud

Mizzou weed science

1/2X Rates of Dicamba vs. 2,4-D on Shade Tree Species



Dicamba vs. 2,4-D on Maple

Dicamba

Mizzou weed science

2,4-D

Up Close Dicamba Injury to Maple

Symptomology of Driftable Fractions of Dicamba vs. 2,4-D on Maple Leaves

Non-Treated

Dicamba

1/200X 1/20X 1/2X

2,4-D

Mizzou weed science

*pictures taken 28 days after treatment

Dicamba and 2,4-D Injury to Sweetgum Trees

Dicamba

2,4-D

American Elm Symptomology 21 DAT

Non-treated

1/20X dicamba + glyphosate

1/20X 2,4-D choline + glyphosate

Mizzou weed science

Symptomology of Driftable Fractions of Dicamba vs. 2,4-D on Oak Leaves

Non-Treated

Dicamba

1/200X 1/20X 1/2X

2,4-D

Mizzou weed science

*pictures taken 28 days after treatment

Oak Dicamba Symptomology 112 DAT

Non-Treated

0.025 lb dicamba

Mizzou weed science

Dicamba vs. 2,4-D at the 1/2X rate on Oak

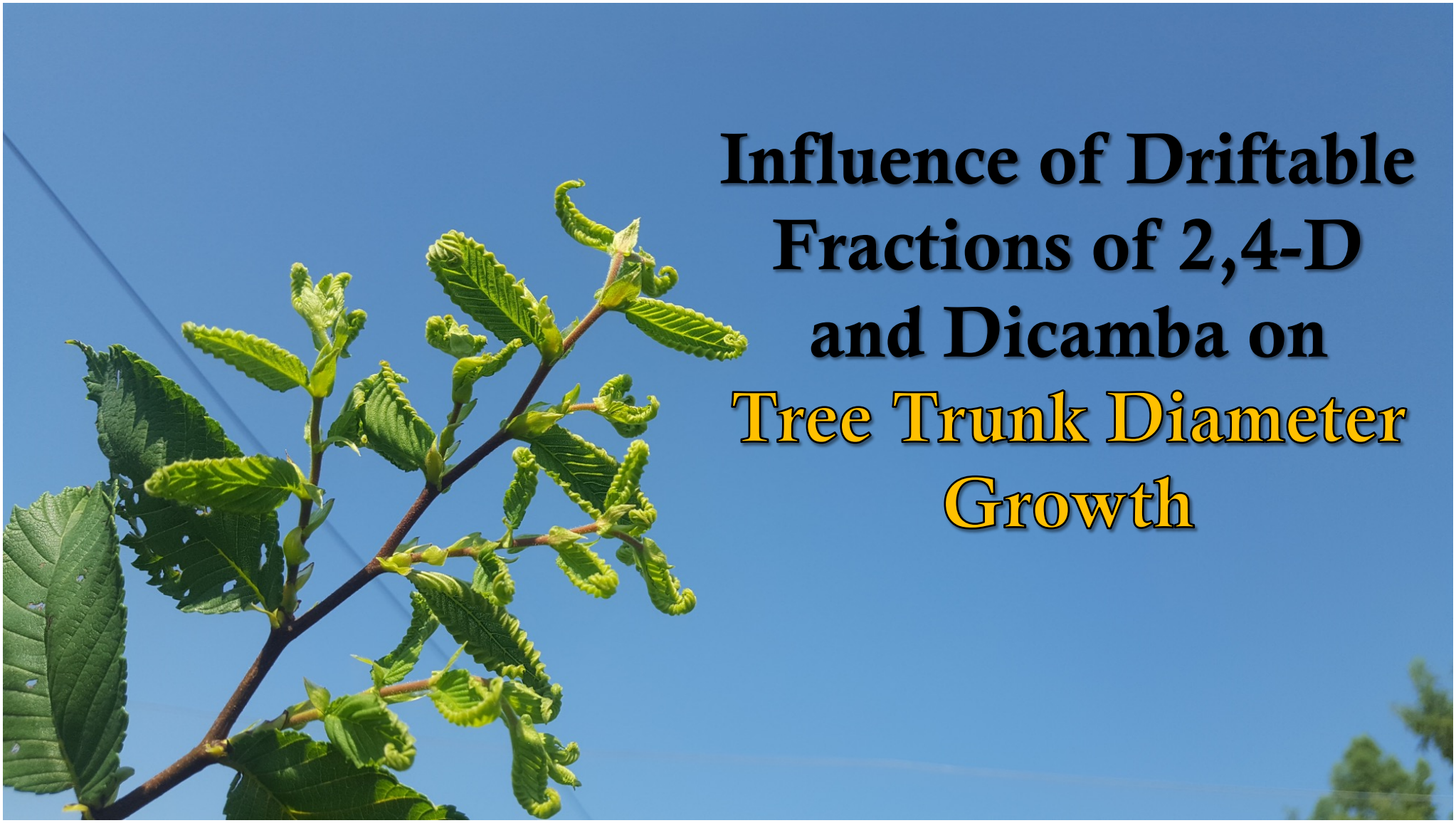
Dicamba

2,4-D

Dicamba vs. 2,4-D at the 1/200X rate on Oak

Dicamba

2,4-D


Influence of Driftable Fractions of 2,4-D and Dicamba on
Tree Trunk Diameter Growth

Influence of Driftable Fractions 2,4-D and Dicamba on Tree Trunk Diameter Growth

Herbicide Treatment (Rate)	Fruit and Ornamental Tree Species						
	❋Apple	❋Peach	✱Walnut	✱Elm	❋Maple	Oak	Dogwood
	Tree Trunk Diameter Growth (mm)						
Non-Treated Control	4.9	6.1	2.9	5.1	6.3	6.7	4.3
2,4-D Choline (1/200)	3.8	5.2	1.8	5.6	5.7	5.8	4.2
2,4-D Choline (1/20)	4.3	5.3	1.5	4.7	5.8	6.4	5.0
2,4-D Choline (1/2)	4.0	4.0*	0.9*	3.4*	5.7	5.4	2.8
2,4-D Choline + Glyphosate (1/200)	4.0	5.4	2.1	5.0	5.2	7.6	5.0
2,4-D Choline + Glyphosate (1/20)	4.0	5.4	1.3*	5.2	6.1	5.7	3.2
2,4-D Choline + Glyphosate (1/2)	4.0	5.4	0.0*	2.5*	6.2	1.9*	0.3*
Dicamba (1/200)	4.0	5.3	2.9	5.1	5.7	5.2	4.5
Dicamba (1/20)	3.8	5.4	3.1	4.9	4.3*	4.5*	3.3
Dicamba (1/2)	3.0*	3.2*	2.1	4.6	4.3*	4.8*	1.5*
Dicamba + Glyphosate (1/200)	4.3	5.3	2.3	4.9	6.7	5.3	4.5
Dicamba + Glyphosate (1/20)	4.8	5.0	2.6	4.5	4.8	5.3	3.4
Dicamba + Glyphosate (1/2)	2.2*	3.6*	0.8*	3.6*	4.5*	4.4*	0.5*

* Indicates significant difference from the non-treated control at the 0.05 level of significance.


Conclusions

Species with a greater sensitivity to dicamba

Based on ALL assessments, the following species were classified as having a greater overall sensitivity to dicamba…

Apple

Maple

Peach

Strawberry

Species with a greater sensitivity to 2,4-D

Based on ALL assessments, the following species were classified as having a greater overall sensitivity to 2,4-D…

Walnut

Grape

Elm

Sweetgum

Conclusions

- Species differ in their **sensitivity** and **symptomology**
- Overall, grape and oak were the most sensitive to the 1/200X rates
- Hydrangea and raspberry were the least sensitive species
- Tree trunk diameter growth correlates with visual injury assessments

Thank you!

- Dr. Kevin Bradley: Advisor
- Dr. Michele Warmund: Committee member
- Dr. Hank Stelzer: Committee member
- Dr. Mandy Bish
- Delbert Knerr
- Fellow graduate students
- Student workers
- HARC Staff

Mizzou weed science

Questions?

Mizzou weed science