

Evaluations of Dicamba and 2,4-D Injury on Common Vegetable and Flower Species



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Why is Dicamba and 2,4-D relevant now?

- ▶ New dicamba-resistant crops (Xtend) and new, 2,4-D resistant crops (Enlist)
- ▶ Increased applications for in-season control of broadleaf weeds in soybean and cotton



2017 DICAMBA COMPLAINTS

Crops damaged as identified by complainants in Missouri

(10/26/2017):

- 108,758 acres of soybeans
- 18,904 tomato plants
- 758 acres of peaches
- 130 acres rice
- 122 acres of watermelons
- 132 acres of vineyards
- 35 acres of alfalfa
- 24 acres certified 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)

Influence of 2,4-D and Dicamba Drift on **Vegetable Species**



Herbicide Treatments

Trade Name	Active Ingredient	1x Rate	Driftable Fraction
Enlist One	2,4-D Choline	0.95 lb ae/A	1/10
			1/100
			1/300
Enlist Duo	2,4-D Choline + Glyphosate	0.95 lb ae/A + 1.0 lb ae/A	1/10
			1/100
			1/300
Xtendimax	Dicamba (DGA + Vapor Grip Technology)	0.5 lb ae/A	1/10
			1/100
			1/300
Xtendimax + Roundup Powermax	Dicamba (DGA +VGT) + Glyphosate	0.5 lb ae/A + .98 lb ae/A	1/10
			1/100
			1/300

Influence of “Driftable Fractions” of 2,4-D and Dicamba Products on Common Garden Species

Herbicide Treatment (Rate)	Garden Species				
	Tomato	Pepper	Watermelon	Cantaloupe	Pumpkin
	----- % Visual Injury 28 DAT -----				
Enlist One (1/300X)	2	0	18	0	2
Enlist One (1/100X)	1	1	8	7	4
Enlist One (1/10X)	74	12	48	60	20
Enlist Duo (1/300X)	3	0	14	0	0
Enlist Duo (1/100X)	16	2	11	12	9
Enlist Duo (1/10X)	95	72	100	100	96
Xtendimax (1/300X)	4	1	1	5	1
Xtendimax (1/100X)	53	1	75	82	29
Xtendimax (1/10X)	58	69	87	82	29
Xtendimax+Rndup (1/300X)	4	2	7	6	4
Xtendimax+Rndup (1/100X)	87	65	100	89	88
Xtendimax+Rndup (1/10X)	95	74	100	100	92
LSD (0.05):	----- 12 -----				

Influence of 2,4-D Choline on Tomato



1/300th of the normal use rate of Enlist One

***photos taken 21 days after application**

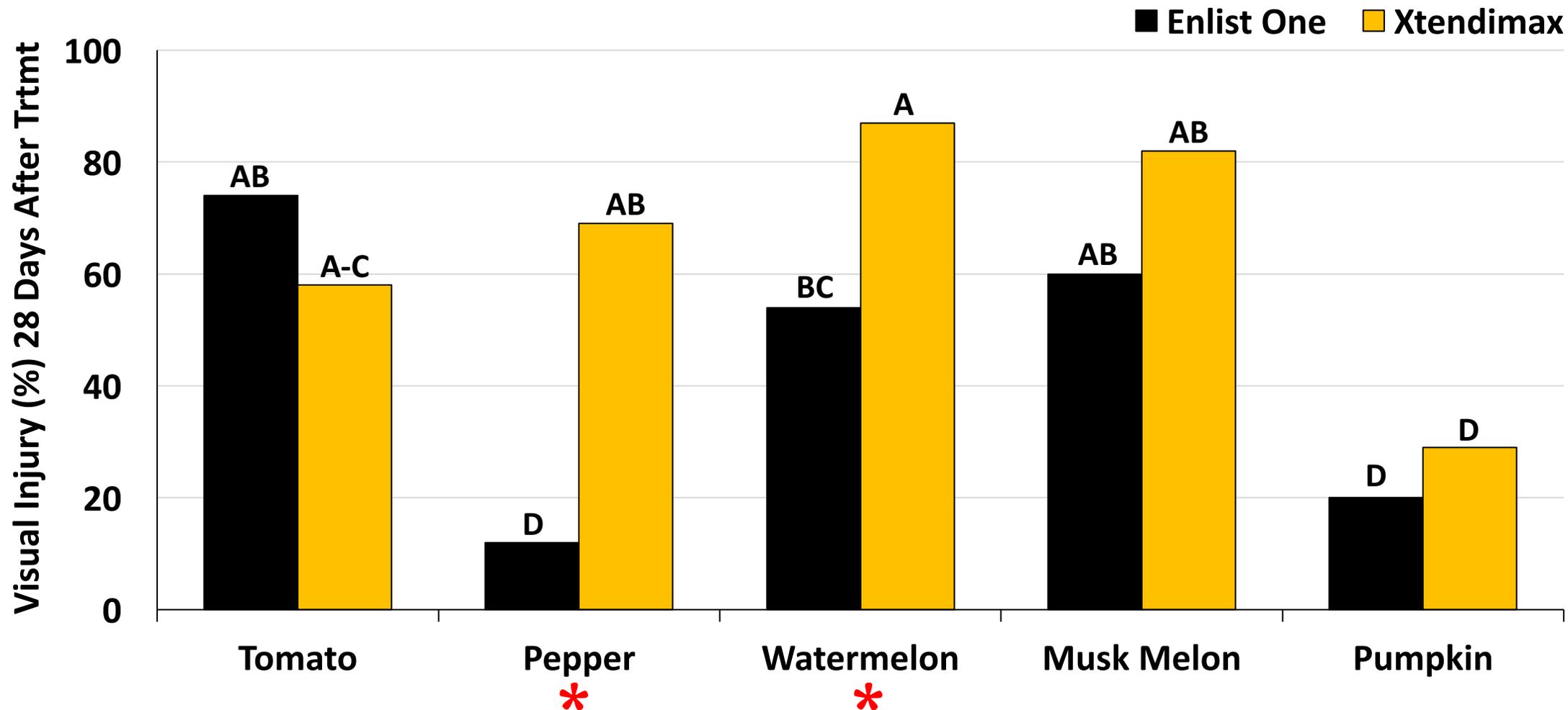
Most Injurious Herbicide Treatments on **Vegetable Species**

(28 days after treatment)

	Herbicide Treatment	Visual Injury (%)
	Enlist Duo (1/10)	93 a
	Xtendimax + Roundup (1/10)	92 a
	Xtendimax + Roundup (1/100)	86 a
*	Xtendimax (1/10)	65 b
	Xtendimax (1/100)	48 c
*	Enlist One (1/10)	44 c
	Enlist Duo(1/100)	9 d
	Xtendimax + Roundup (1/300)	5 de
	Enlist One (1/100)	5 de
	Enlist One (1/300)	2 de
	Xtendimax (1/300)	2 de
	Enlist Duo (1/300)	0.7 e

*means followed by the same letter are not different, P=0.05

Influence of Enlist One and Xtendimax on Vegetable Species at 1/10th the Normal Use Rate



*means followed by the same letter are not different, P=0.05

Influence of Enlist One on Pepper

1/300th



1/100th



1/10th



***photos taken 21 days after application**

Influence of Xtendimax on Pepper

1/300th



1/100th

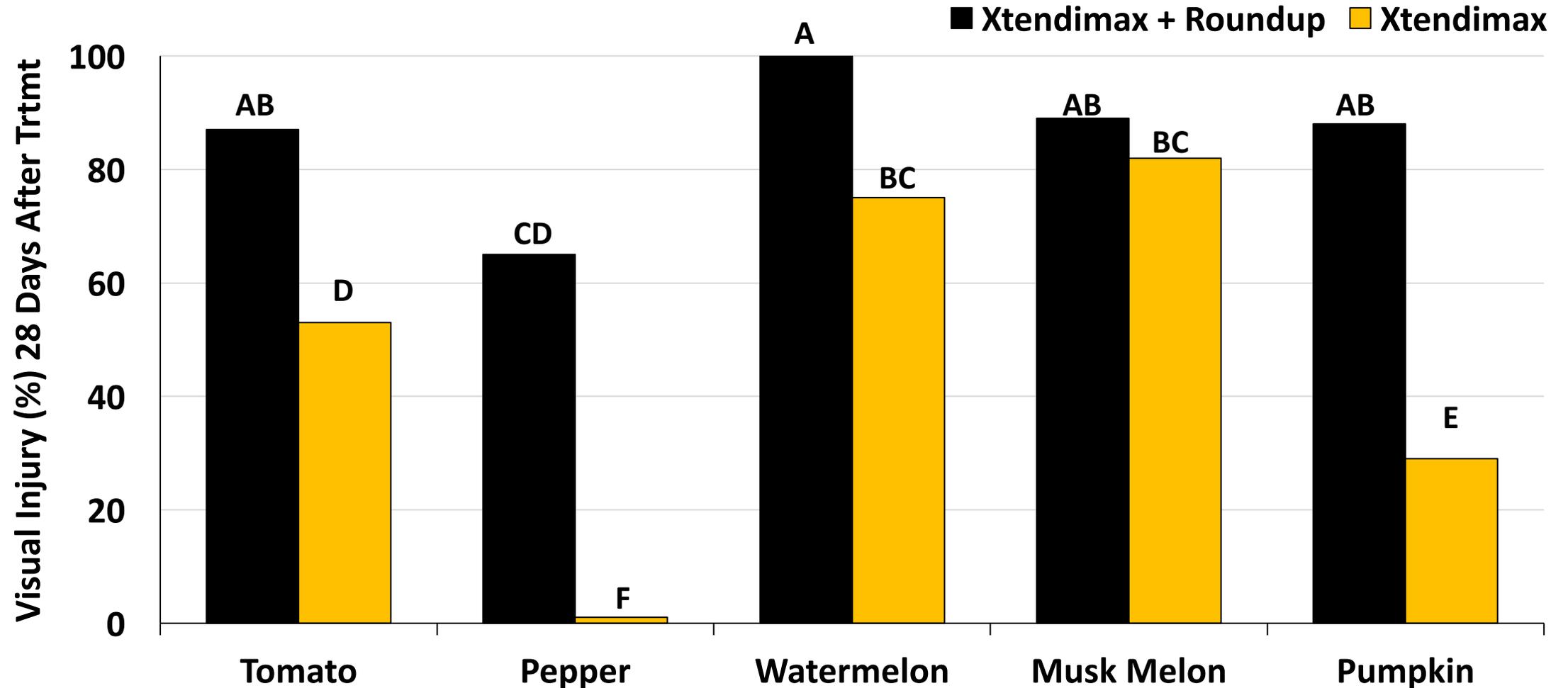


1/10th



***photos taken 21 days after application**

Influence of Xtendimax + Roundup vs. Xtendimax on Vegetable Species at 1/100th the Normal Use Rate



*means followed by the same letter are not different, P=0.05

Influence of Xtendimax on Tomato

1/300th



1/100th



1/10th



***photos taken 21 days after application**

Influence of Xtendimax + Roundup on Tomato

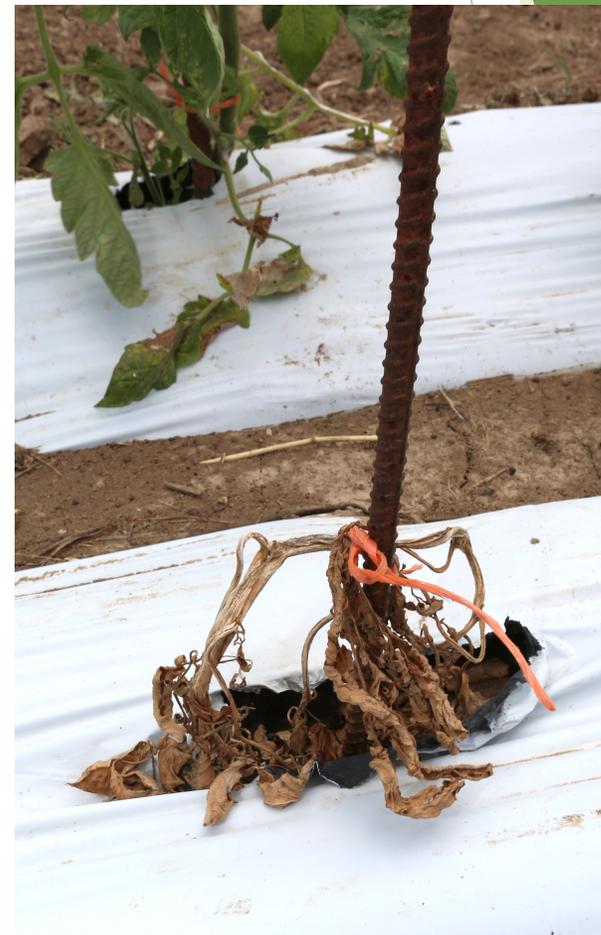
1/300th



1/100th



1/10th



***photos taken 21 days after application**

Influence of Xtendimax on Watermelon

1/300th



1/100th



1/10th



***photos taken 21 days after application**

Influence of Glyphosate + Xtendimax on Watermelon

1/300th



1/100th

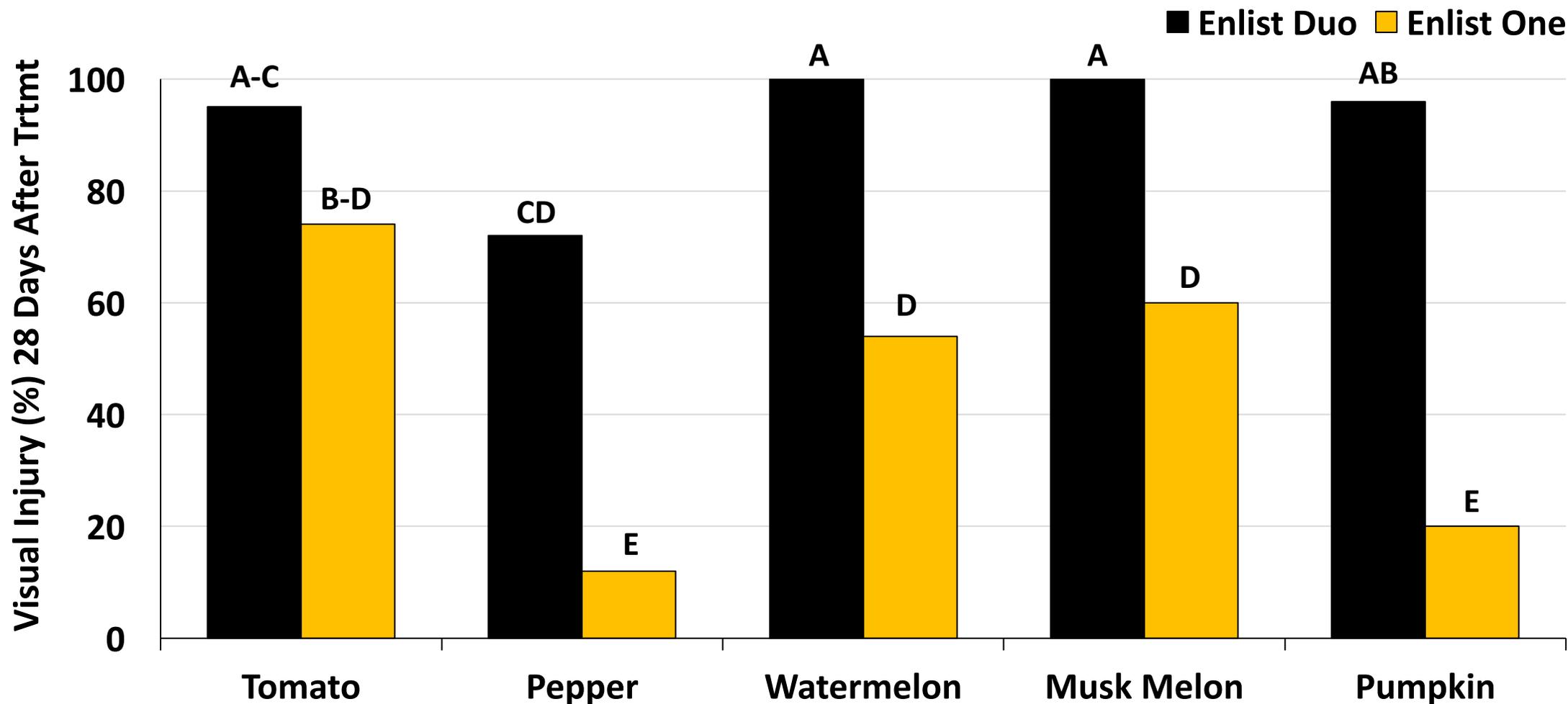


1/10th



***photos taken 21 days after application**

Influence of Enlist One vs. Enlist Duo on Vegetable Species at 1/10th of the Normal Use Rate



*means followed by the same letter are not different, P=0.05

Influence of Enlist One on Tomato

1/300th



1/100th



1/10th



***photos taken 21 days after application**

Influence of Enlist Duo on Tomato

1/300th



1/100th



1/10th



***photos taken 21 days after application**

Influence of Enlist One on Musk Melon

1/300th



1/100th



1/10th



Influence of Enlist Duo on Musk Melon

1/300th



1/100th



1/10th



***photos taken 21 days after application**

Influence of 2,4-D and Dicamba Drift on Common **Flower Species**



Most Injurious Herbicide Treatments on Flower Species

(summary at 28 Days After Treatment)

Herbicide Treatment	Visual Injury (%)
Enlist Duo (1/10X)	21 a
Xtendimax + Roundup (1/10X)	20 a
Xtendimax + Roundup (1/100X)	14 b
Enlist One (1/10X)	9 c
Xtendimax (1/10X)	4 d
Xtendimax (1/100X)	2 de
Enlist Duo (1/100X)	0.4 e
Xtendimax (1/300X)	0.4 e
Xtendimax + Roundup (1/300X)	0.3 e
Enlist Duo (1/300X)	0.1 e
Enlist One (1/100X)	0.1 e
Enlist One (1/300X)	0.1e

*means followed by the same letter are not different, P=0.05

Influence of “Driftable Fractions” of 2,4-D and Dicamba Products on Ornamental Flower Species

Herbicide Treatment (Rate)	Ornamental Flower Species								
	Impatiens	Geranium	Petunia	Marigold	Coleus	Zinnia	Begonia	Vinca	Hosta
	----- % Visual Injury 28 Days After Treatment -----								
2,4-D Choline (1/300X)	0	0	0	0	0	0	1	0	0
2,4-D Choline (1/100X)	0	0	0	0	0	0	1	0	0
2,4-D Choline (1/10X)	1	56	0	0	7	0	28	0	0
Enlist Duo (1/300X)	0	0	0	1	0	0	0	0	0
Enlist Duo (1/100X)	0	0	0	1	2	0	2	0	0
Enlist Duo (1/10X)	2	55	61	6	64	8	29	8	0
Xtendimax (1/300X)	0	1	0	0	3	0	0	0	0
Xtendimax (1/100X)	2	3	0	0	8	1	5	2	0
Xtendimax (1/10X)	7	6	0	1	19	3	11	0	0
Xtendimax+Rndup (1/300X)	1	0	0	0	0	0	2	0	0
Xtendimax+Rndup (1/100X)	6	11	53	7	56	14	1	2	2
Xtendimax+Rndup (1/10X)	7	19	71	14	68	15	14	11	6
LSD (0.05):	----- 8 -----								

Influence of 2,4-D and Dicamba on Petunia

Non-treated



1/10th Enlist One



1/10th Enlist Duo



1/10th Xtendimax

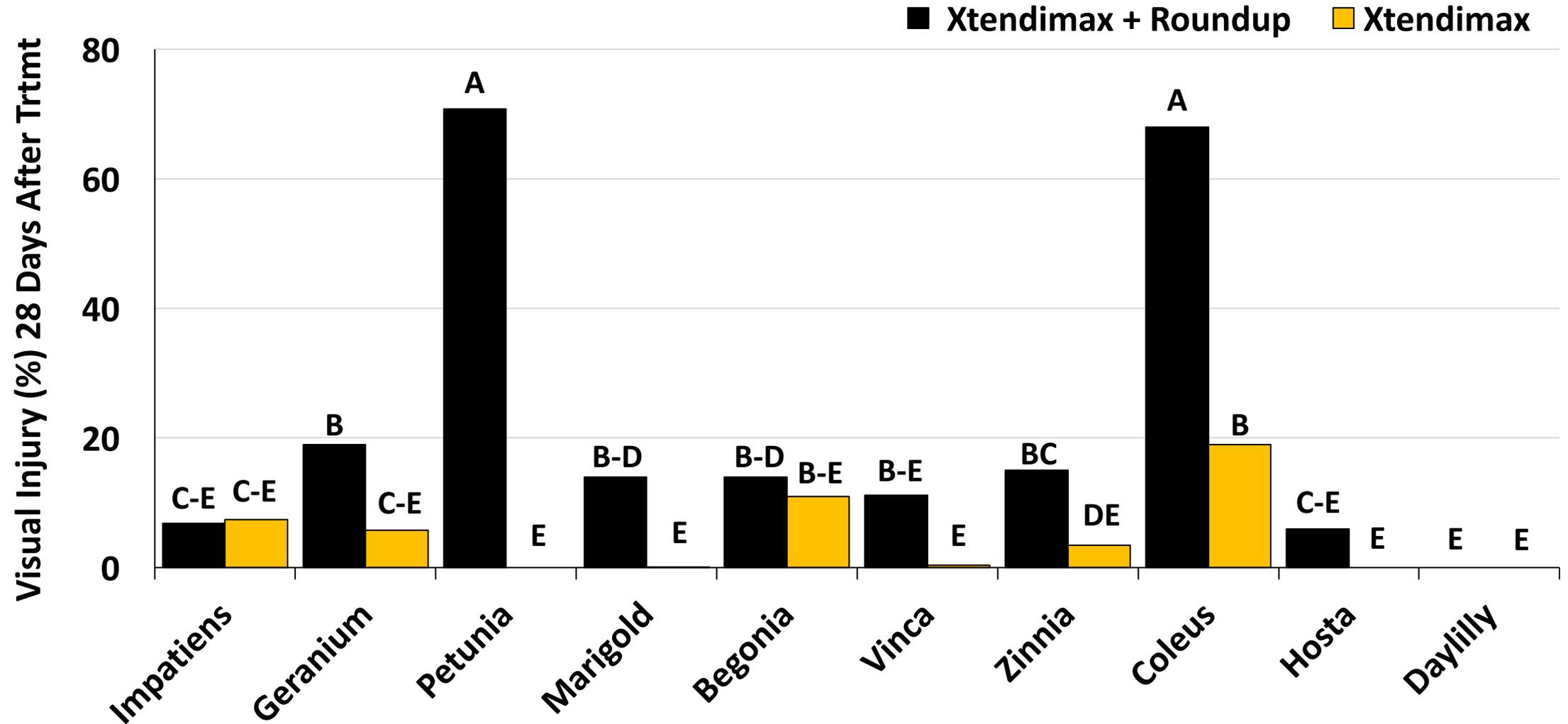


1/10th Xtendimax + Roundup



***photos taken 21 days after application**

Influence of Xtendimax and Roundup + Xtendimax on Flower Species at 1/10th the Normal Use Rate



*means followed by the same letter are not different, P=0.05

Influence of Dicamba on Coleus

Non-treated



1/10th Xtendimax

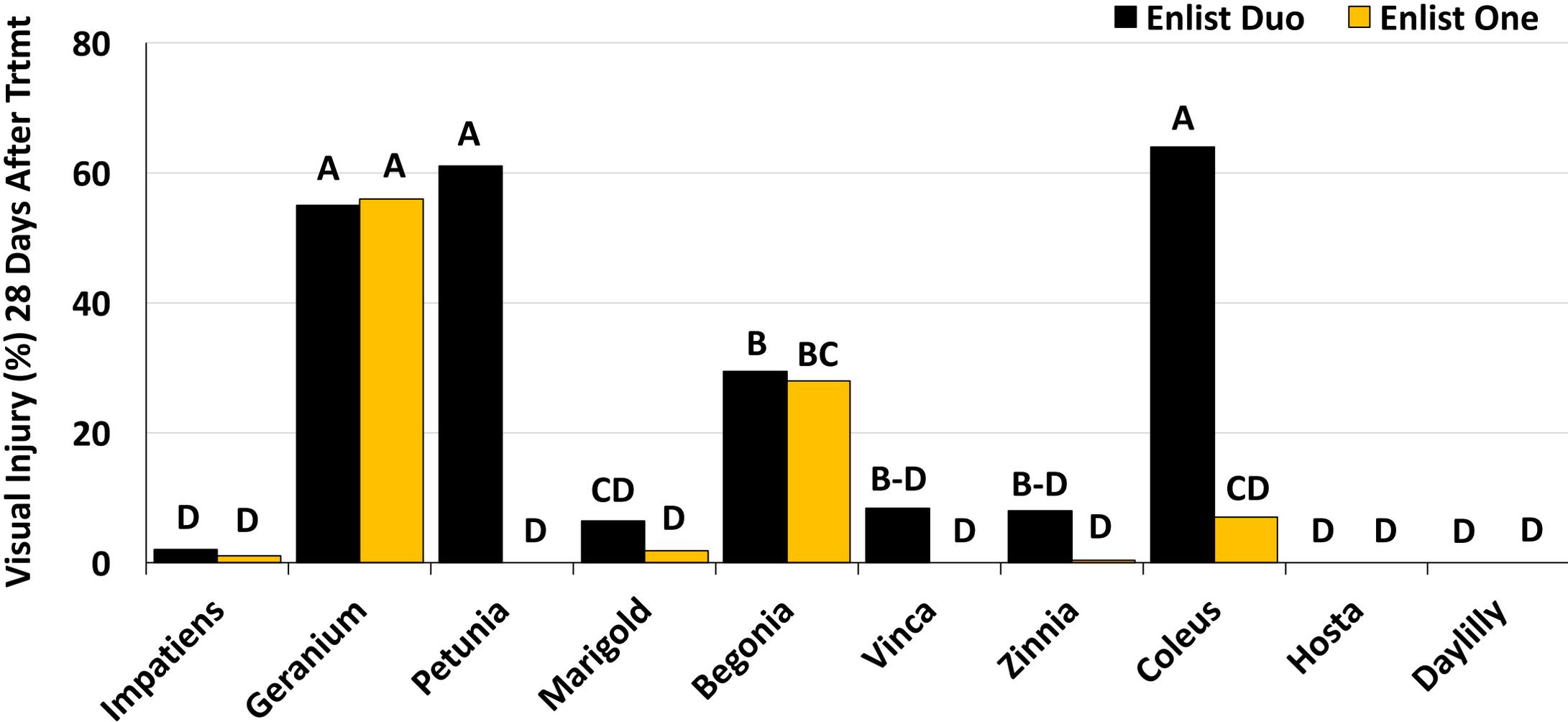


1/10th Xtendimax + Roundup



***photos taken 21 days after application**

Influence of Enlist Duo and Enlist One on Common Flower Species at 1/10th the Normal Use Rate



*means followed by the same letter are not different, P=0.05

Influence of 2,4-D on Coleus

Non-treated



1/10th Enlist One



1/10th Enlist Duo



***photos taken 21 days after application**

Conclusions

- ▶ Glyphosate greatly increased injury symptoms for all species tested
- ▶ Common vegetable species are very sensitive to 2,4-D and dicamba
- ▶ Annual flower species are much more tolerant of even the highest rates of 2,4-D and dicamba evaluated



Mizzou® Weed science

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The screenshot shows the homepage of the Mizzou Weed Science website. At the top, there is a navigation bar with the Mizzou logo, the text "WEED SCIENCE", and "Division of Plant Sciences — CAFNR". There are also social media icons for Facebook, Twitter, and YouTube, and a search bar. Below the navigation bar, there is a sidebar with a list of links: Home, Weed ID Guide, Herbicide Injury, Publications, Slideshows, Videos, Research Results, and Personnel. The main content area features a large image of a Maypop passionflower (Passiflora incarnata) with a caption: "Maypop passionflower (*Passiflora incarnata*) is an increasing problem weed in a number of Missouri pastures." To the right of this image is a "Fun Facts" section titled "weed science" with a sub-heading "Fun Facts". The text in this section reads: "Scotch thistle (*Onopordum acanthium*) is said to have helped win a battle. Norsemen came ashore planning to surprise sleeping Scottish forces and removed their boots for a quieter assault. A prickly patch of thistle growing between the two armies is said to have saved the day and became the Scottish national flower." At the bottom of the page, there is a welcome message: "Welcome to the University of Missouri's Weed Science homepage. Here you can find information related to our extension, research, and teaching programs or visit some of our web resources like the Missouri Weed Identification or Herbicide Injury Guides. In our 'Research Results' section, you can search results from our field research by year, herbicide, weed, or crop. Additionally, you can click on our publication section to see all of the publications and newsletter articles we provide as well as to view and/or listen to some of our power point presentations. We welcome your comments and/or suggestions about this site."

App: ID Weeds (free download)

The logo for the ID Weeds app, featuring the text "id weeds" in a green, lowercase, sans-serif font. The letter "i" is stylized with a small green leaf above it. The background is a solid green rectangle.

Facebook: Mizzou Weed Science

The Facebook logo, consisting of the word "facebook" in a white, lowercase, sans-serif font on a blue rectangular background.

Twitter: @ShowMeWeeds

The Twitter logo, consisting of the word "twitter" in a white, lowercase, sans-serif font on a blue rectangular background, with the white bird icon to the right.