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

Weed Control System Enlist™ Soybeans

Weed Control System Enlist™ Cotton

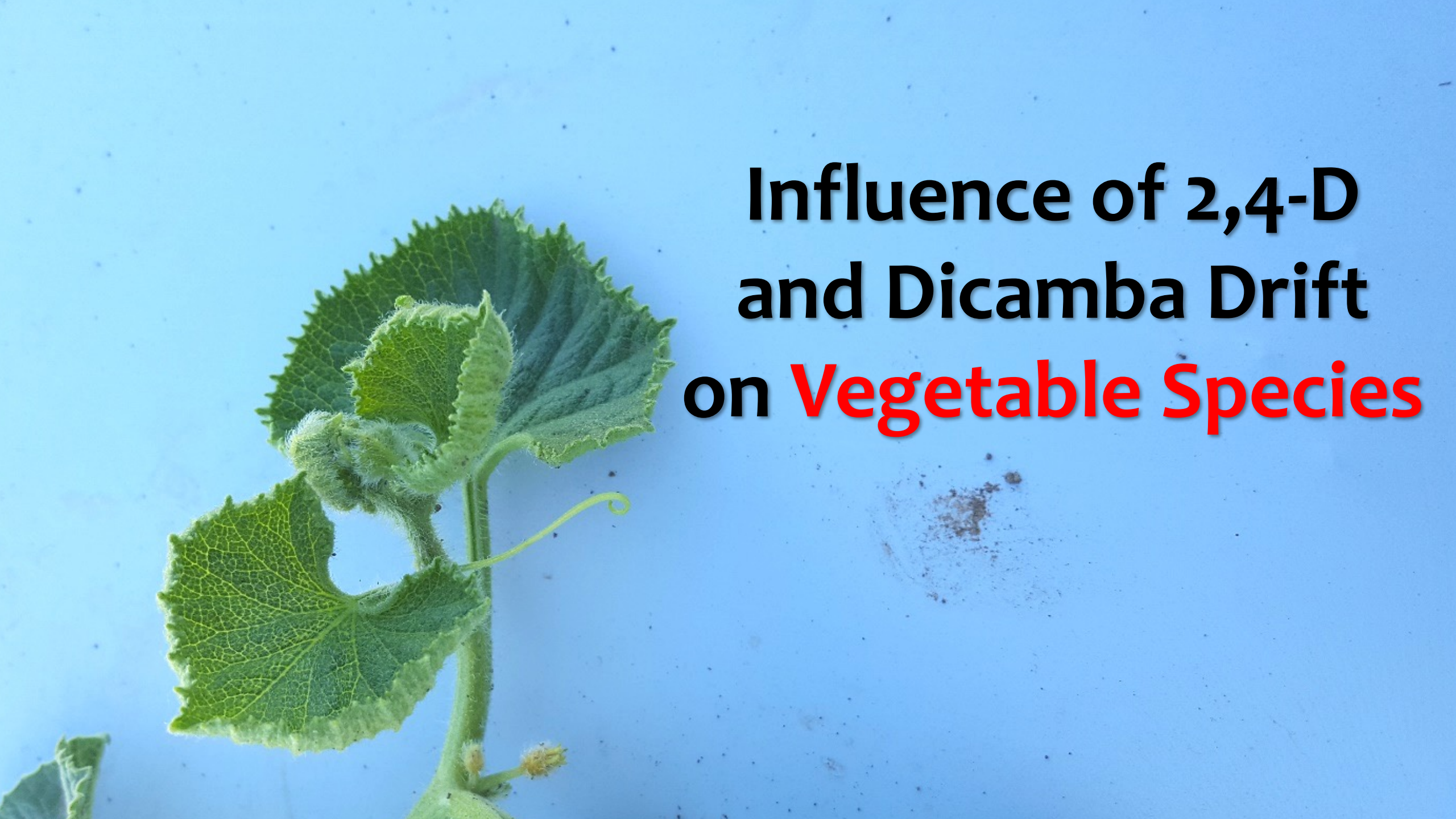
BOLLGARD II® XTENDFLEX® COTTON

ROUNDUP READY 2 XTEND® SOYBEANS

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

	Garden Species				
Herbicide Treatment (Rate)	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**

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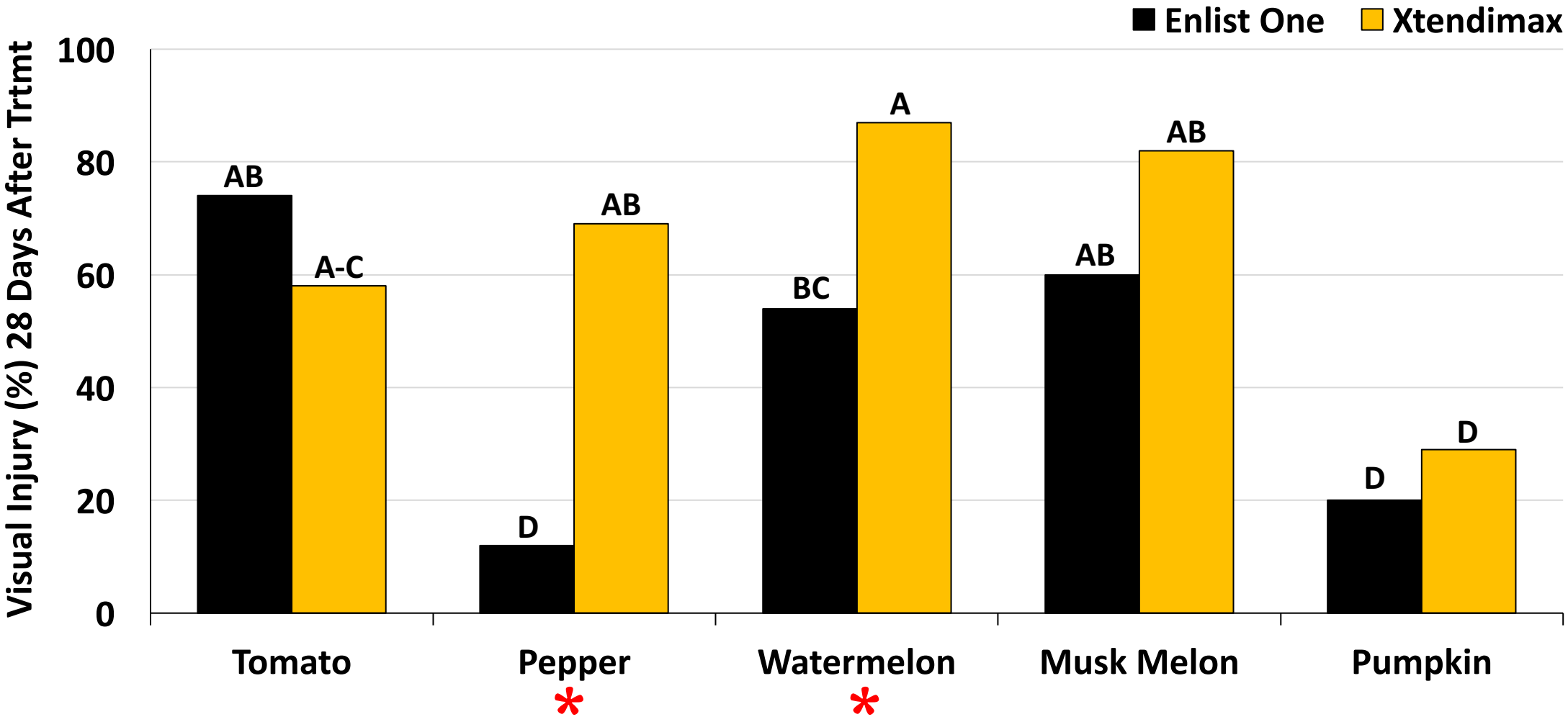
Most Injurious Herbicide Treatments on Vegetable Species

(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**

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Influence of Xtendimax on Pepper

1/300th

1/100th

1/10th

***photos taken 21 days after application**

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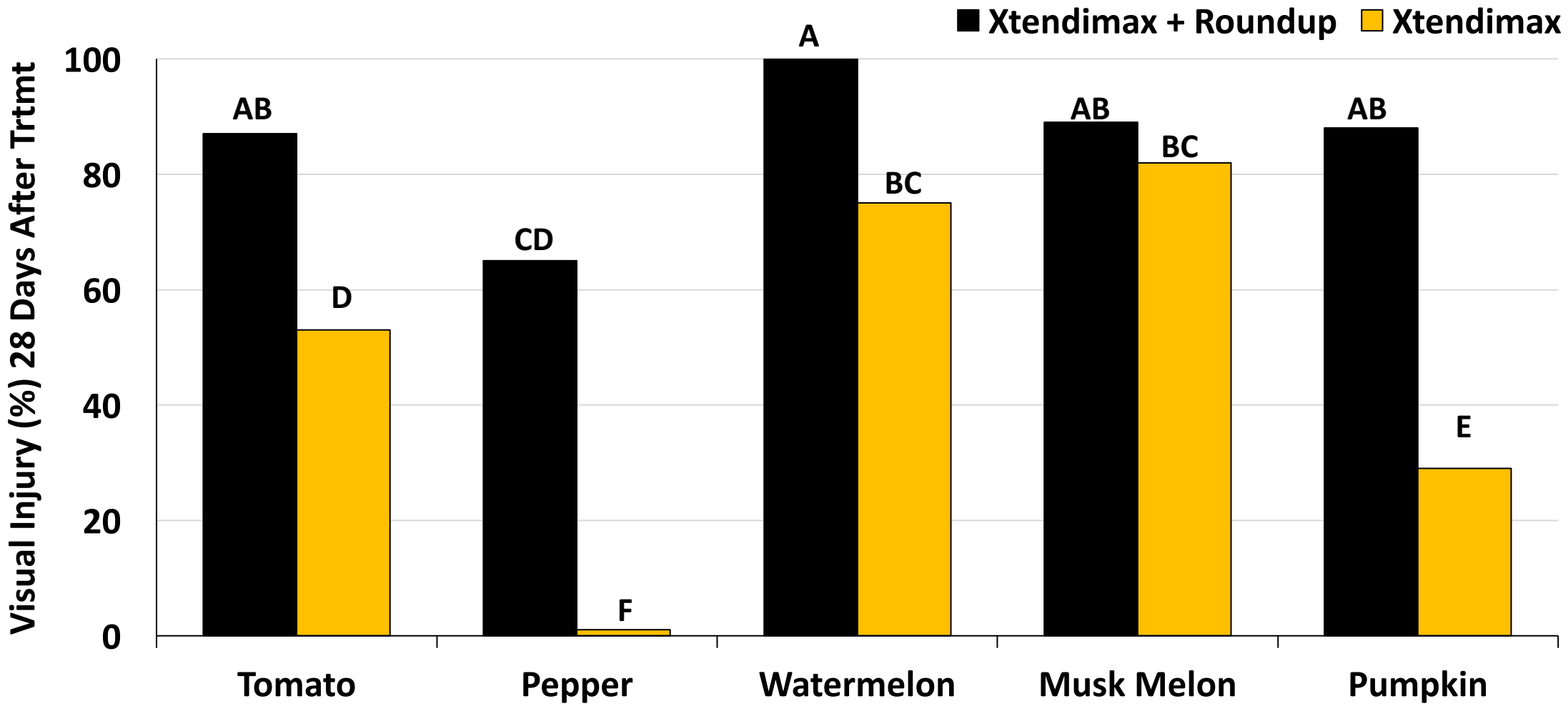
Influence of Xtendimax + Roundup vs. Xtendimax on Vegetable Species at 1/100th the Normal Use Rate



*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**

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Influence of Xtendimax + Roundup on Tomato

1/300th

1/100th

1/10th

***photos taken 21 days after application**

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Influence of Xtendimax on Watermelon

1/300th

1/100th

1/10th

***photos taken 21 days after application**

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Influence of Glyphosate + Xtendimax on Watermelon

1/300th

1/100th

1/10th

***photos taken 21 days after application**

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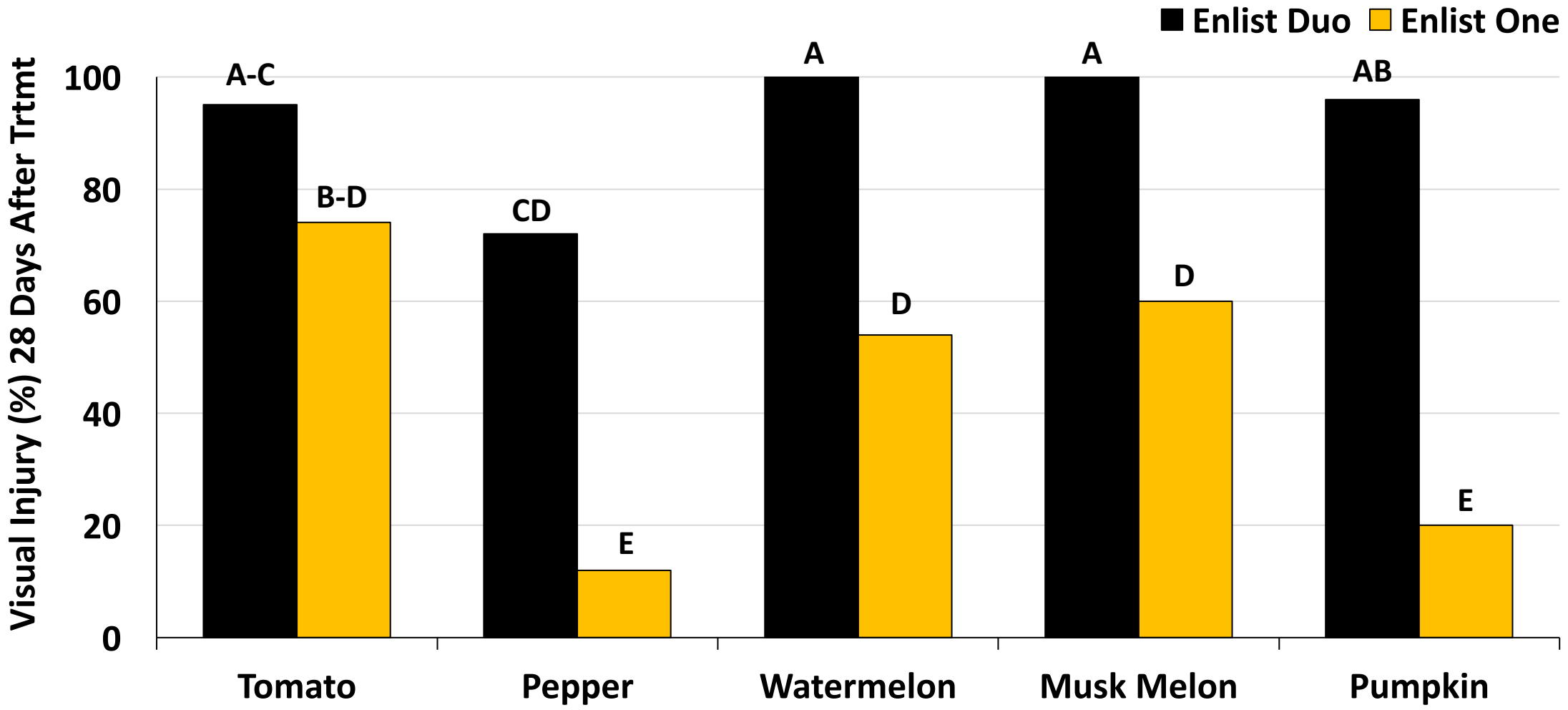
Influence of Enlist One vs. Enlist Duo on Vegetable Species at 1/10th of the Normal Use Rate



*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**

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Influence of Enlist Duo on Tomato

1/300th

1/100th

1/10th

***photos taken 21 days after application**

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Influence of Enlist One on Musk Melon

1/300th

1/100th

1/10th

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Influence of Enlist Duo on Musk Melon

1/300th

1/100th

1/10th

***photos taken 21 days after application**

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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**

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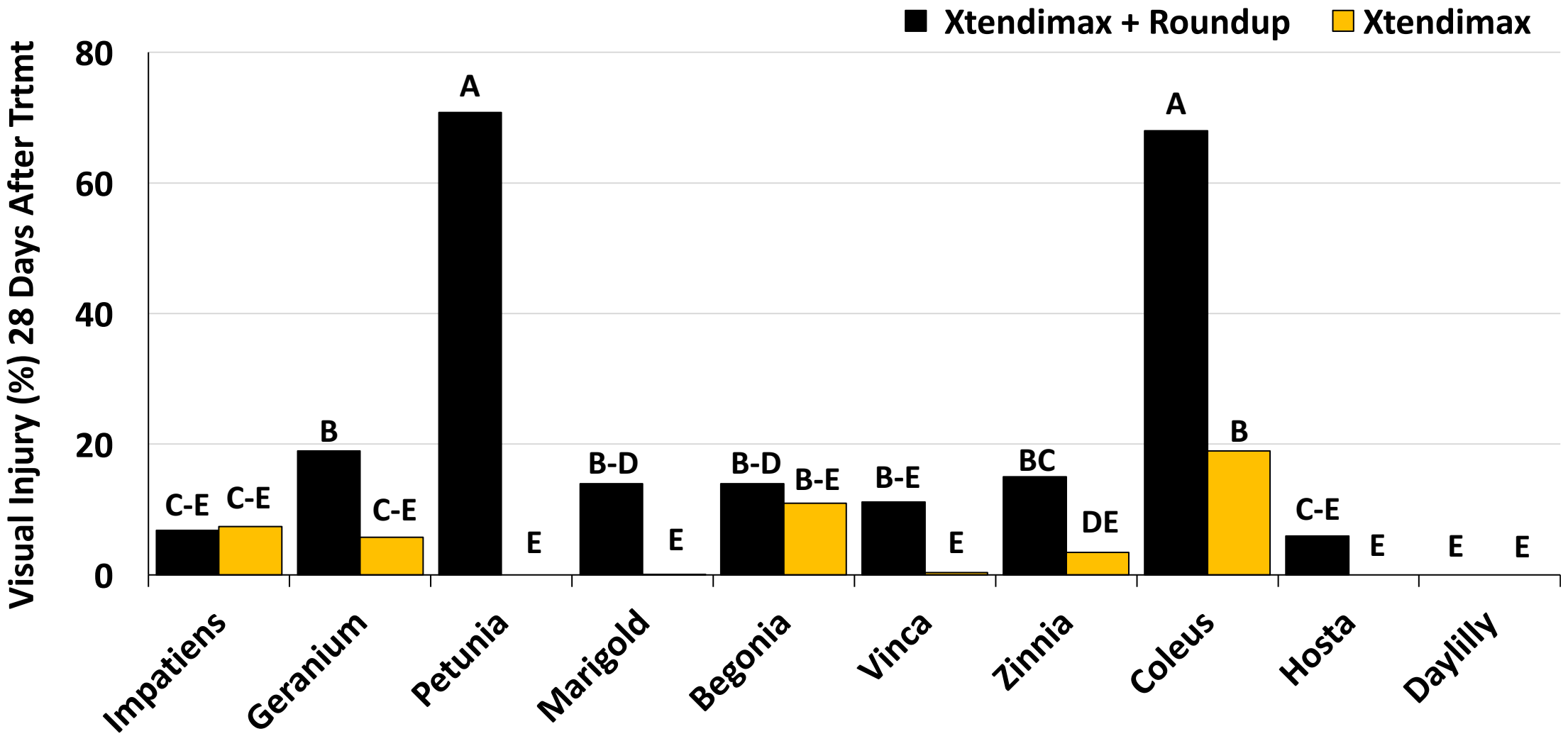
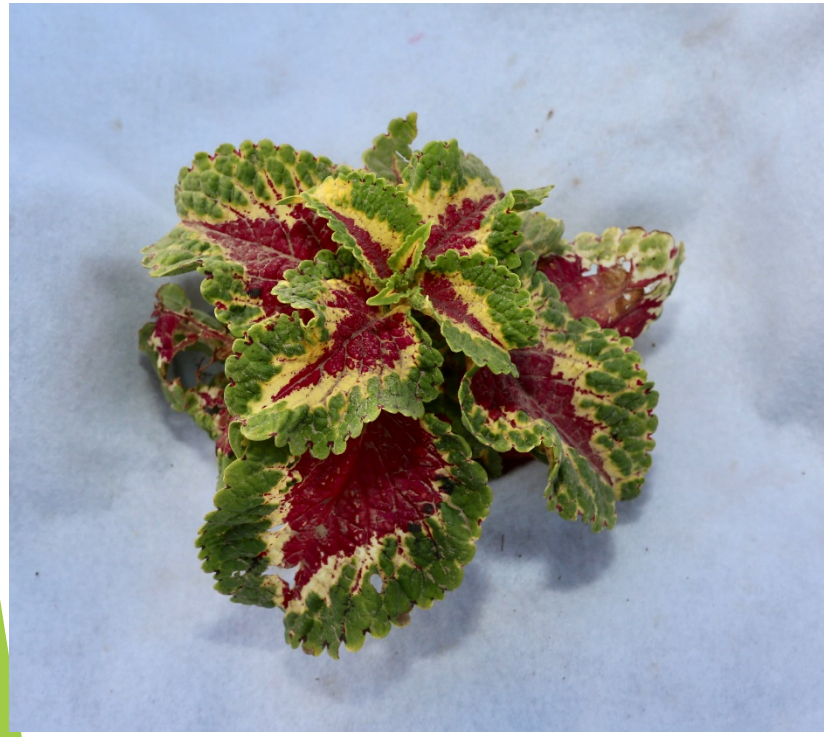
Influence of Xtendimax and Roundup + Xtendimax on Flower Species at 1/10th the Normal Use Rate



*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**

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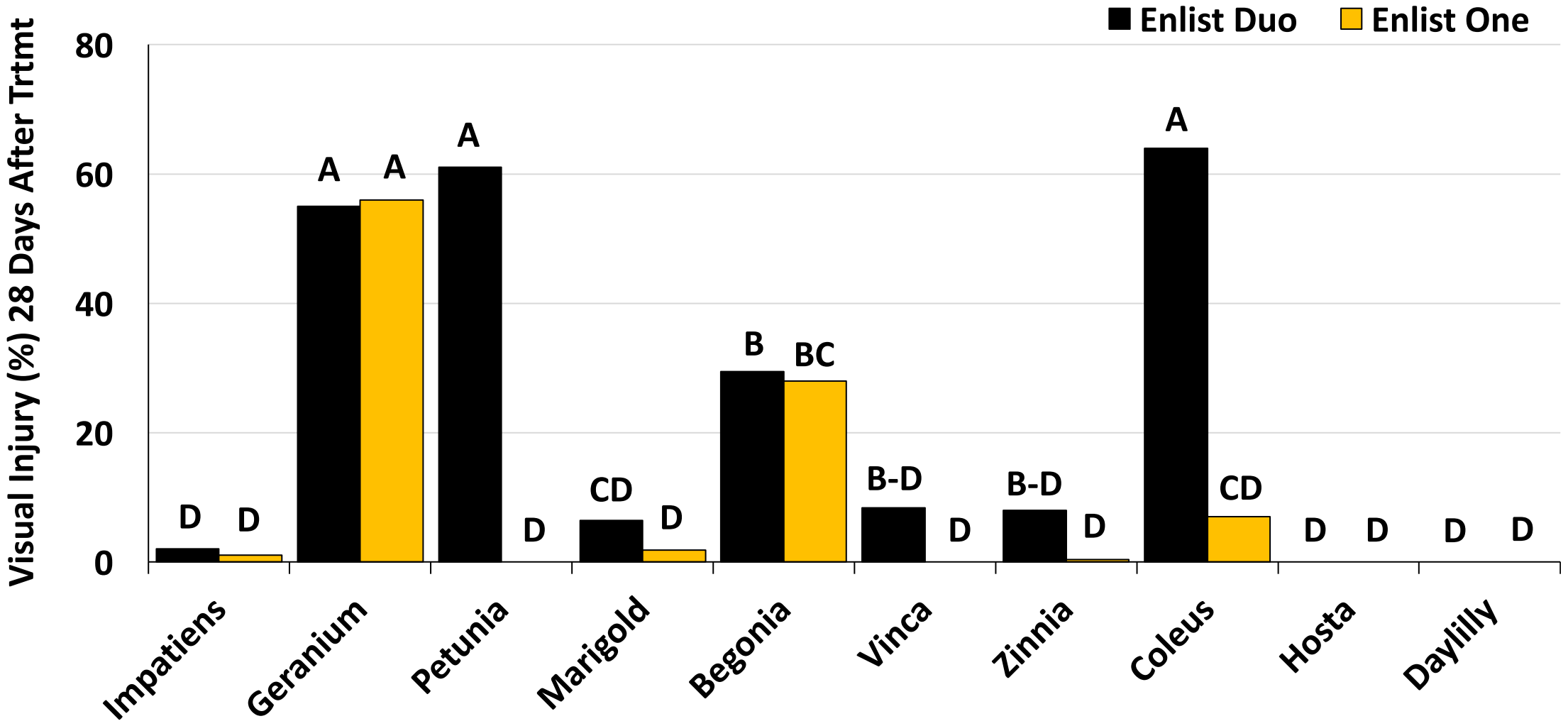
Influence of Enlist Duo and Enlist One on Common Flower Species at 1/10th the Normal Use Rate



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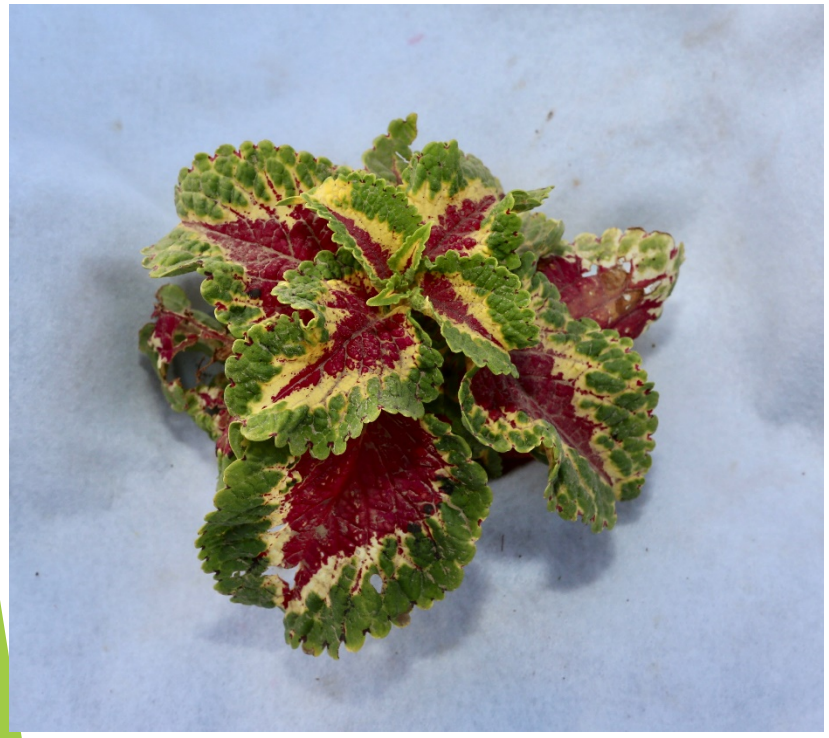
Influence of 2,4-D on Coleus

Non-treated



1/10th Enlist One

1/10th Enlist Duo

*photos taken 21 days after application

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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

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weed science

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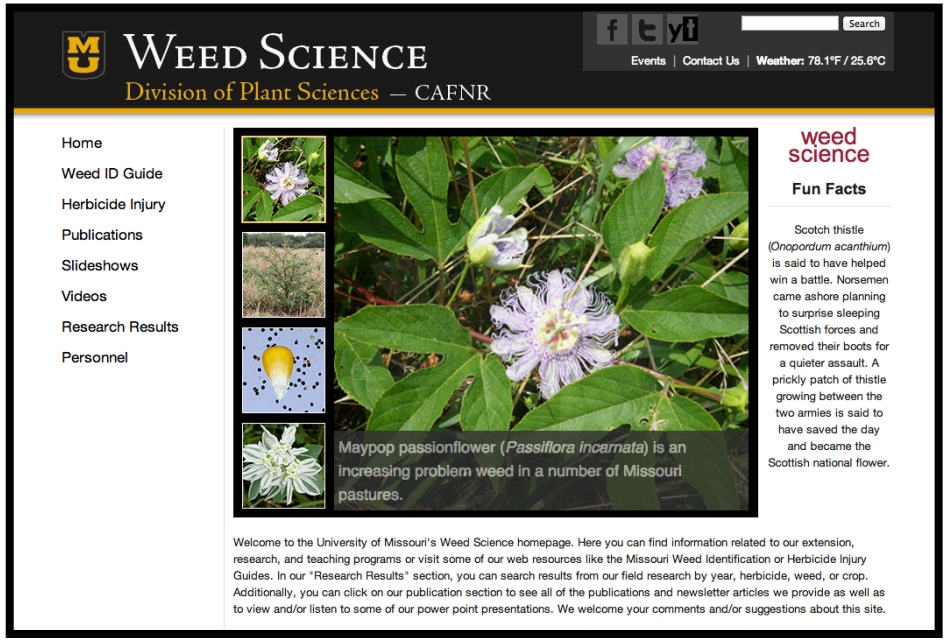

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