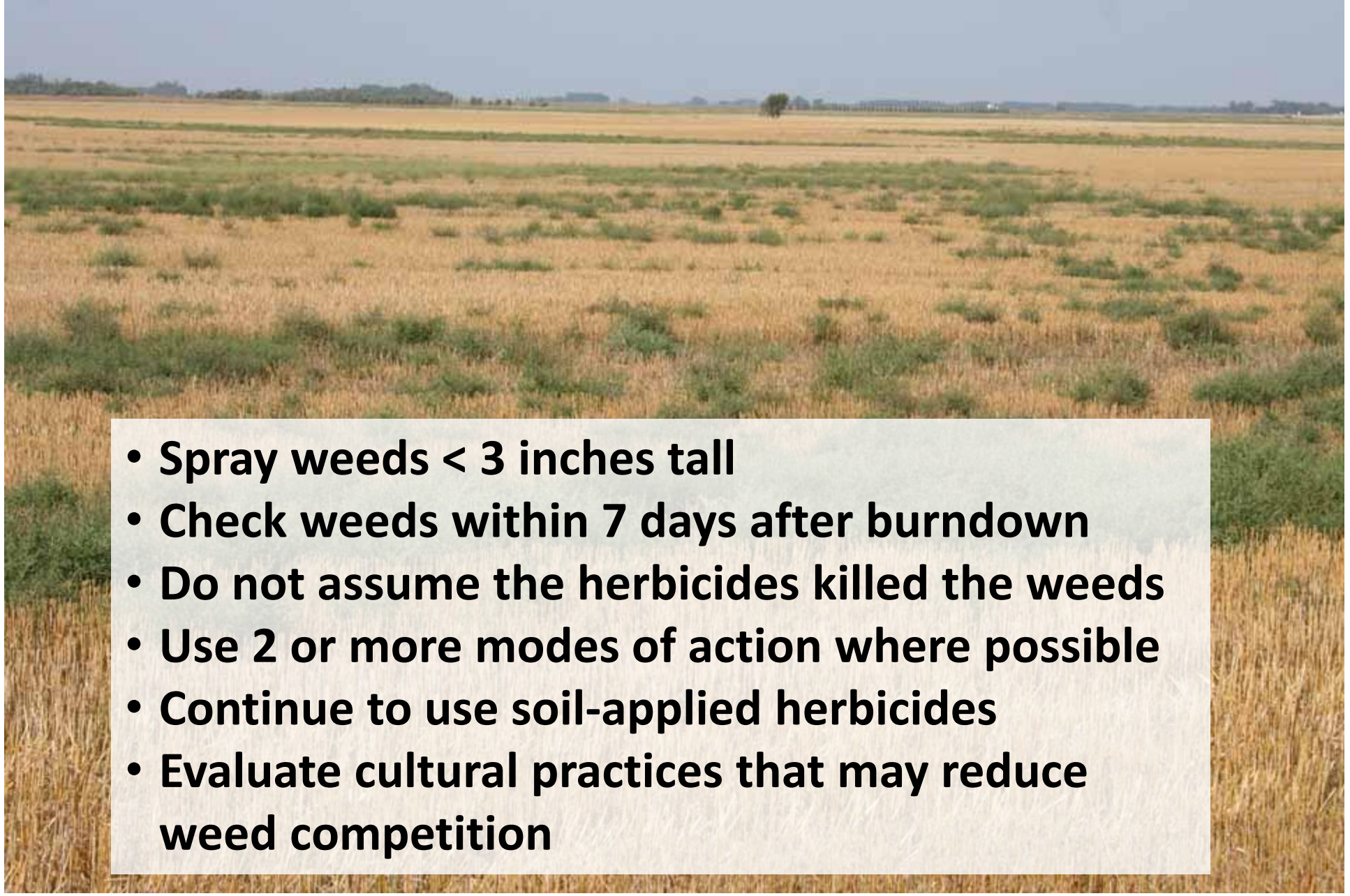
2023 Weed Control Update

Brian Jenks
North Dakota State University



- Spray weeds < 3 inches tall
- Check weeds within 7 days after burndown
- Do not assume the herbicides killed the weeds
- Use 2 or more modes of action where possible
- Continue to use soil-applied herbicides
- Evaluate cultural practices that may reduce weed competition

Canola/Mustard:

Glyphosate
Aim
Gramoxone

Sunflower/Safflower/Flax/Faba:

Glyphosate
Aim / Sp Ch
Gramoxone

Dry pea/Lentil/Chickpea:

Glyphosate
Sharpen
Aim / Sp Ch
Gramoxone

Canola/Mustard:

~~**Glyphosate**~~

Aim

Gramoxone

Sunflower/Safflower/Flax/Faba:

~~**Glyphosate**~~

Aim / Sp Ch

Gramoxone

Callisto (flax)? PC

Dry pea/Lentil/Chickpea:

~~**Glyphosate**~~

Sharpen

Aim / Sp Ch

Gramoxone

Canola/Mustard:

~~**Glyphosate**~~

~~**Aim**~~

Gramoxone

Sunflower/Safflower/Flax/Faba:

~~**Glyphosate**~~

~~**Aim / Sp Ch**~~

Gramoxone

Callisto (flax)? PC

Dry pea/Lentil/Chickpea:

~~**Glyphosate**~~

~~**Sharpen**~~

~~**Aim / Sp Ch**~~

Gramoxone

Aim 1 and 2 oz with AMS + MSO

6 DAT

Kochia sprayed at 2-2.5”

3 reps

Aim 1 and 2 oz with AMS + MSO

8 DAT

Kochia sprayed at 2-2.5”

3 reps

Aim 1 and 2 oz
with AMS + MSO

13 DAT

Kochia sprayed
at 2-2.5”

3 reps

Sharpen 1 & 2 oz with AMS + MSO

6 DAT

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8 DAT

Kochia sprayed at 2-2.5”

3 reps

Sharpen 1 & 2 oz with AMS + MSO

13 DAT

Kochia sprayed at 2-2.5”

3 reps

Group 14

- Aim
- Sharpen
- Vida
- Reviton

} Burndown herbicides

- Spartan/Charge/Elite
- Authority products
- Valor

} Soil-applied herbicides (residual)

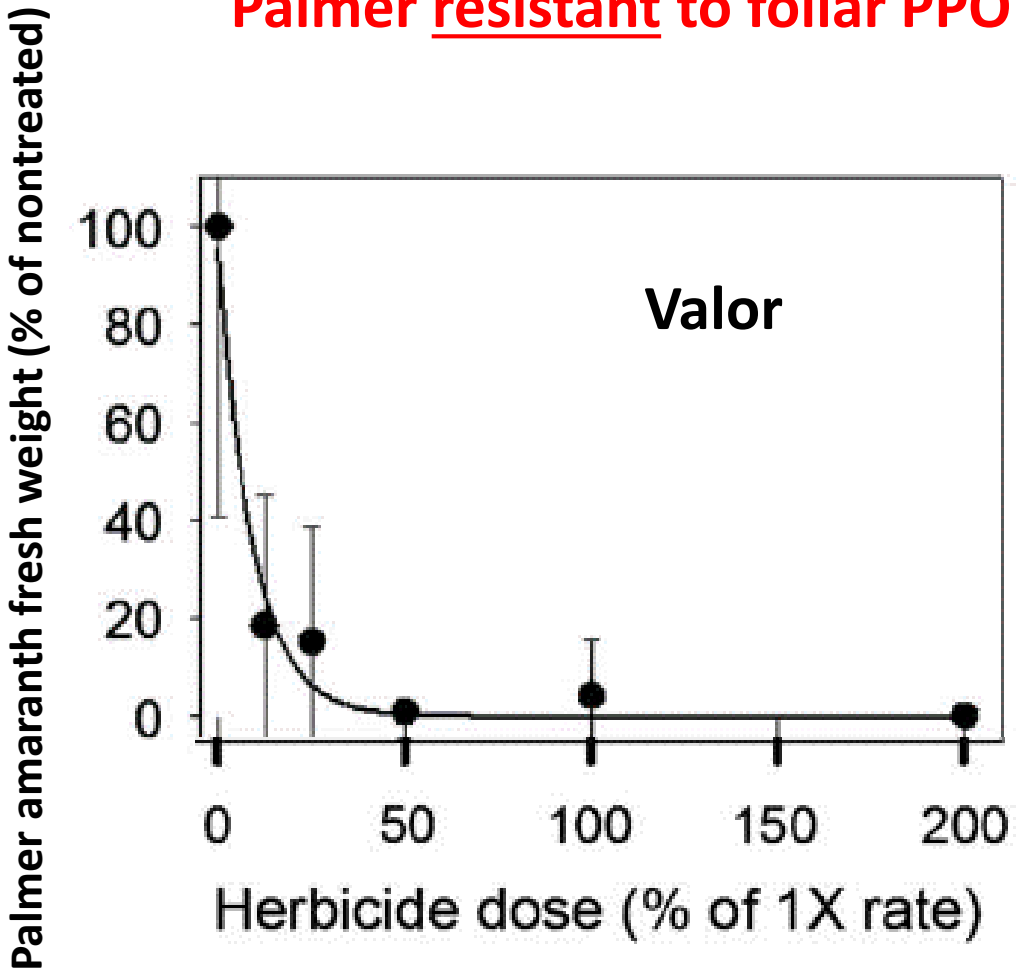
- Flexstar
- Cobra
- Ultra Blazer

} Foliar soybean herbicides

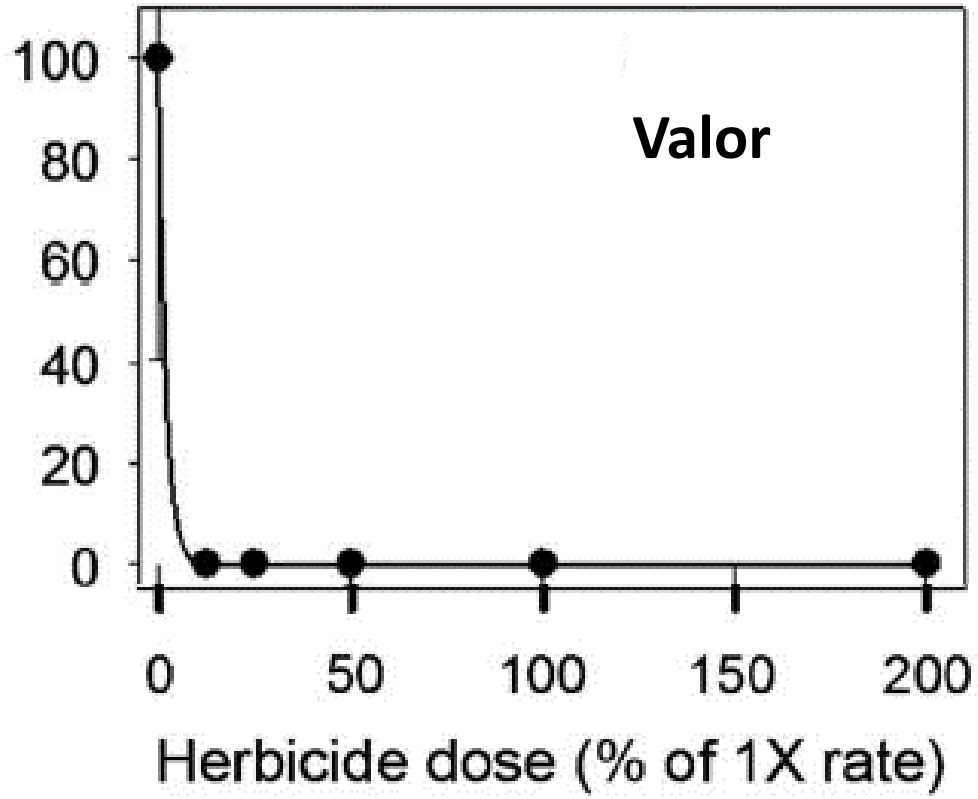
Will residual Group 14's control kochia that are resistant to foliar Group 14's?

Short answer: Based on experience with waterhemp and Palmer, kochia control with Valor and Spartan "may" still be effective or only slightly reduced. Research started.

Palmer resistant to foliar PPO

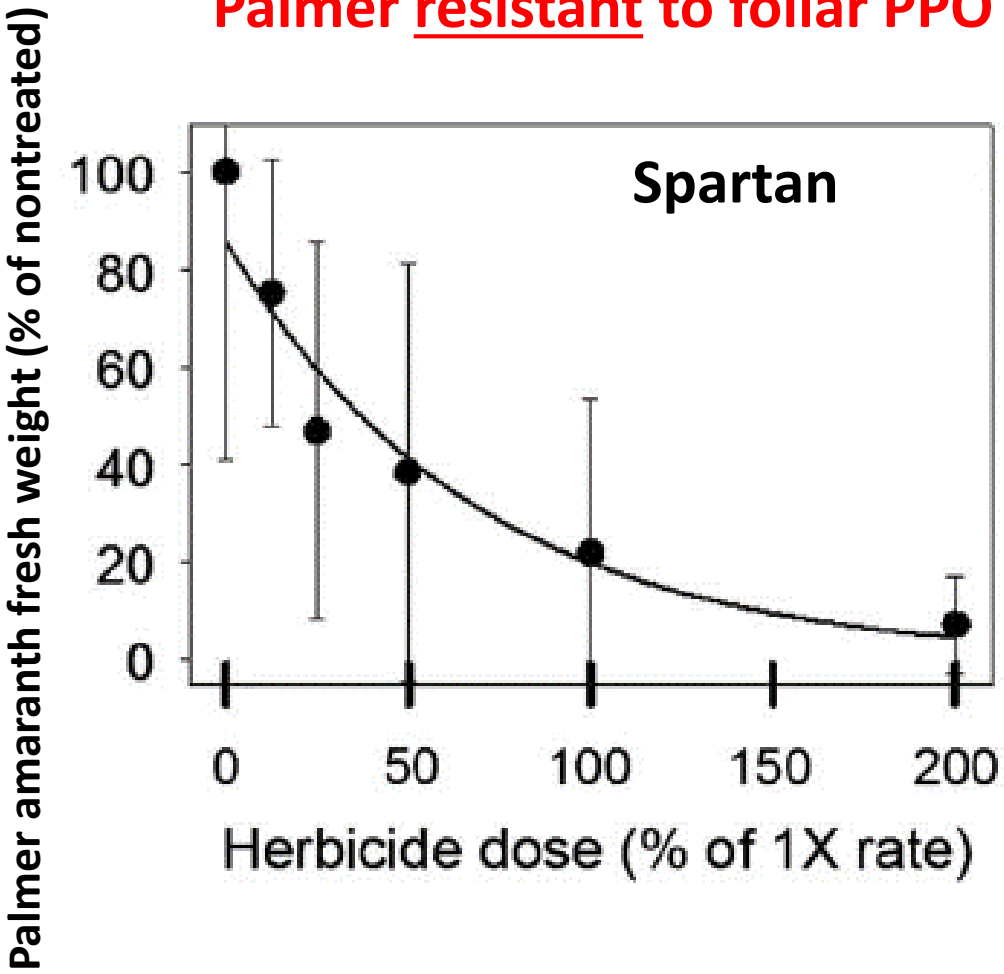


Palmer susceptible to foliar PPO

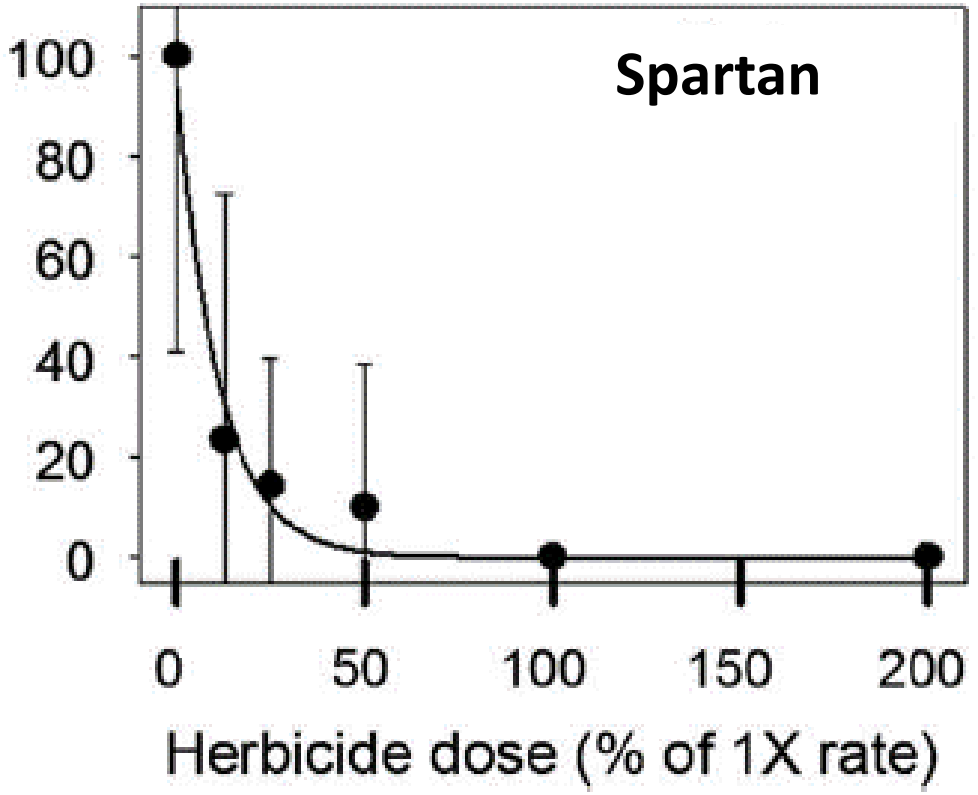


Adapted from Umphres et al. Weed Tech (2018) 32:95–100

Palmer resistant to foliar PPO



Palmer susceptible to foliar PPO



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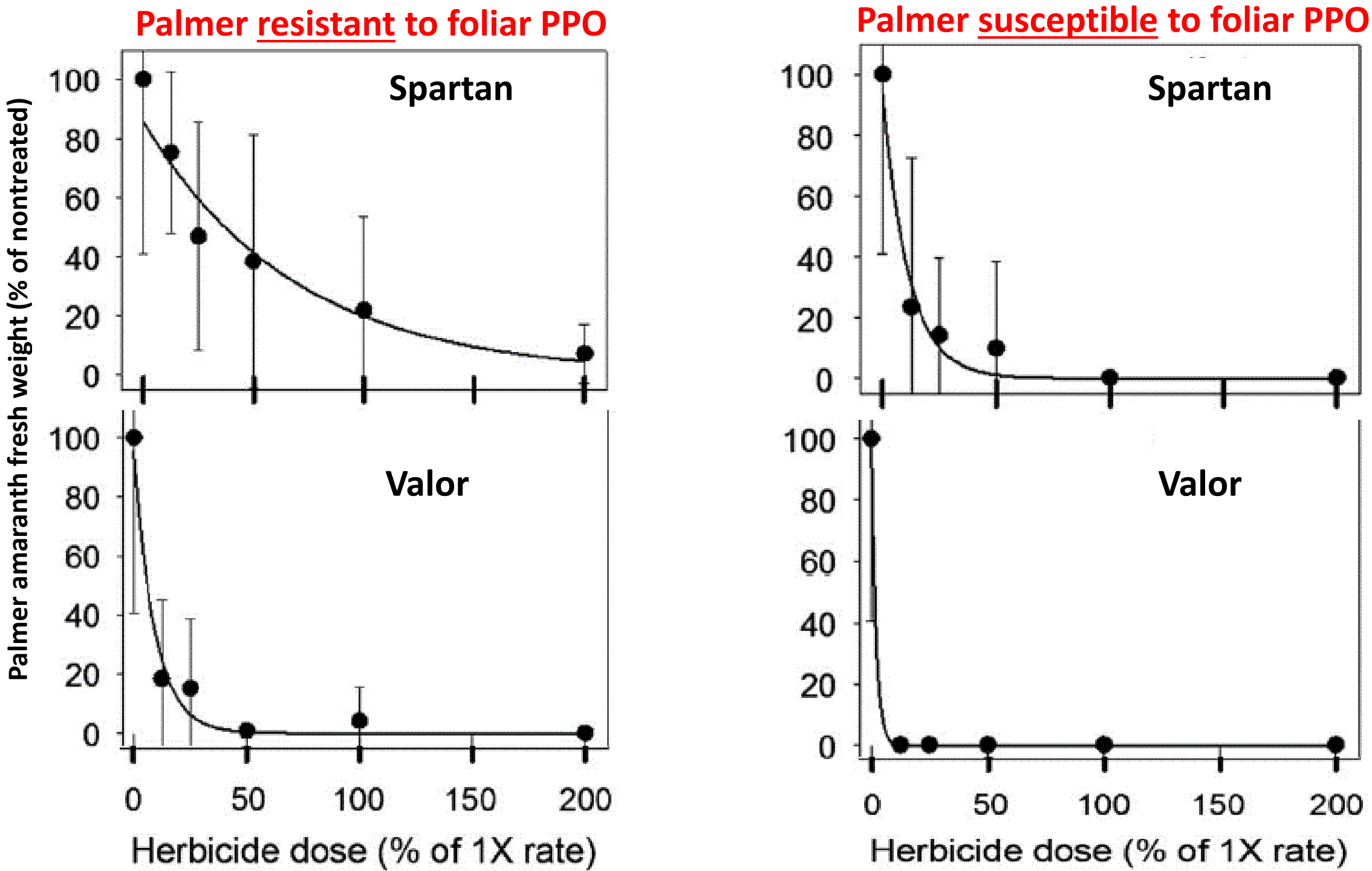

Palmer resistant to foliar PPO
Palmer susceptible to foliar PPO
Spartan
Valor
Spartan
Valor
Palmer amaranth fresh weight (% of nontreated)
0
20
40
60
80
100
0
50
100
150
200
Herbicide dose (% of 1X rate)
Herbicide dose (% of 1X rate)

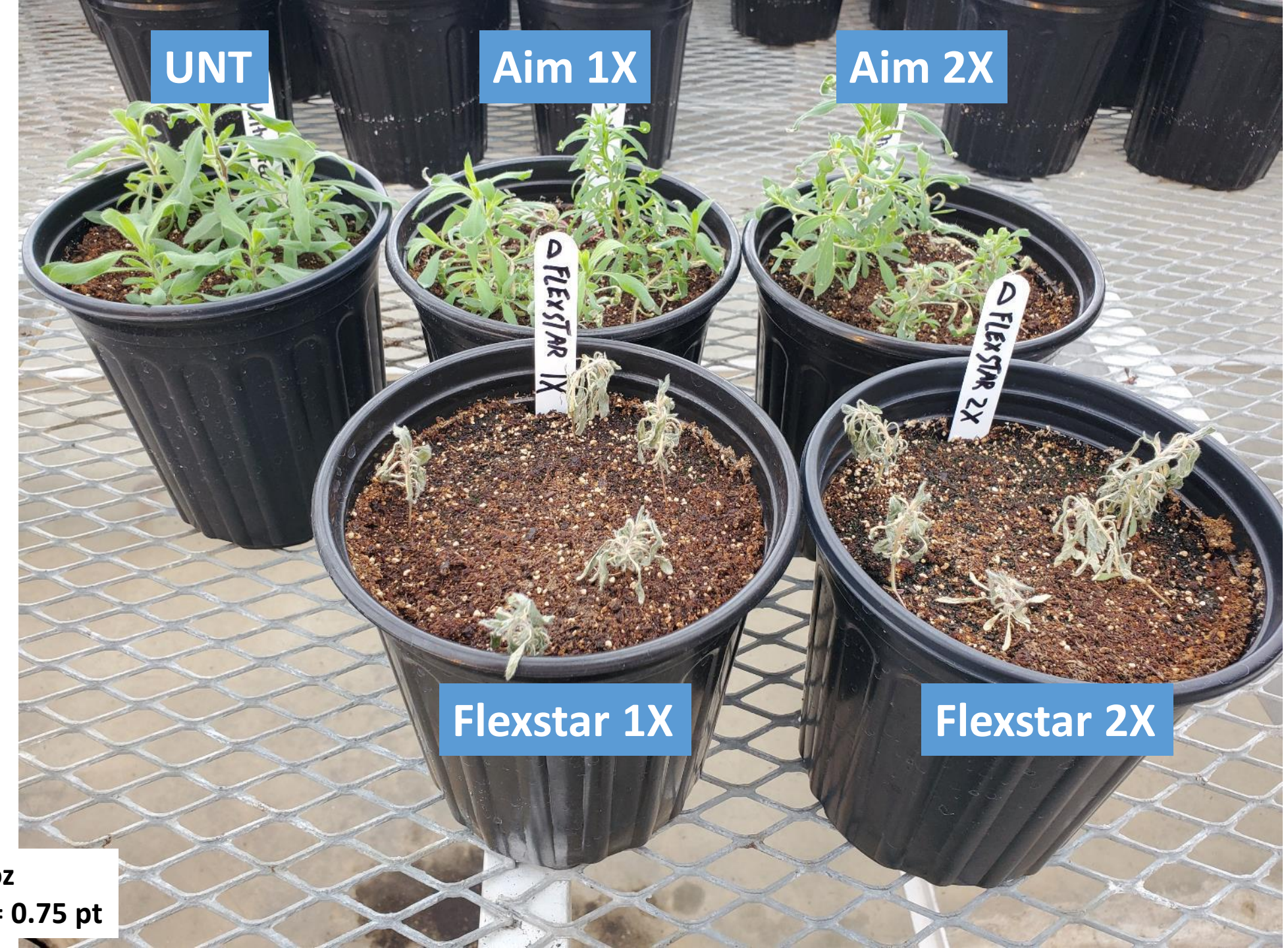
Kochia control with Aim 1 oz to 16 oz

Minot

Susceptible

Photo: 6 DAT

Minot



Aim 1X = 1 oz
Flexstar 1X = 0.75 pt

How do we proceed?

- Not every kochia plant/population is resistant.
- Need to be vigilant in scouting after application.
- Scout fields 5-7 DAT. Should have dead plants at 7 DAT.
- Continue to use residual herbicides.
- Use Metribuzin where possible.
- Use multiple effective modes of action where possible.
- One recommendation/recipe does not fit every grower or field

Kochia control with spring-applied herbicides (2020)

Treatment	Rate	Timing	May 9 0.40”	May 24 0.54”	Jun 6 0.61”
		May 6	May-22	May-29	Jun-11
Untreated			0	0	0
Spartan[a]	4 oz	PRE	75	59	43
Authority MTZ[a]	11 oz	PRE	97	94	89
Spartan + Sharpen[a]	4 oz + 1 oz	PRE	73	58	37
Glyphosate + AMS	32 oz + 2.5 gal	PRE	56	42	25

*Kochia <1” tall at application

**69 F at application.

[a]Applied with MSO (1%) + AMS (2.5 gal)

Spring kochia control (2020)

May 24 0.54” Jun 6 0.61”

Treatment	Rate	Timing	Kochia control		
		May 15	May-22	May-29	Jun-11
Untreated			0	0	0
Reglone + NIS	1.5 pt + 0.25%	PRE	80	62	32
Reglone + Spartan Charge[a]	1.5 pt + 5 oz	PRE	74	60	33
Reglone + Metribuzin + NIS	1.5 pt + 0.25 lb + 0.25%	PRE	97	95	89
Reglone + Aim[a]	1.5 pt + 1 oz	PRE	66	50	23
Reglone + Sharpen[a]	1.5 pt + 1 oz	PRE	74	53	27
LSD (0.05)			3.2	2.6	4.5

[a]Applied with MSO (1%) + AMS (2.5 gal)

**66 F at application*

**Kochia <1” tall at PRE application.*

Minot 2020

Effect of metribuzin on emerged kochia control (2020)

[a]All treatments applied as a burndown

Treatment[a]	Rate	% Kochia control	
		Jun-8	Jun-19
Untreated		0	0
Spartan[b]	4 oz	64	58
Spartan + Gly[b]	4 oz + 22 oz	71	70
Spartan + Gly + Metribuzin[b]	4 oz + 22 oz + 0.25 lb	84	80
Spartan + Metribuzin[b]	4 oz + 0.25 lb	73	65
Sharpen[b]	1 oz	48	42
Sharpen + Gly[b]	1 oz + 22 oz	79	75
Sharpen + Gly + Metribuzin[b]	1 oz + 22 oz + 0.25 lb	87	84
Sharpen + Metribuzin[b]	1 oz + 0.25 lb	75	65
Reglone + NIS	1.5 pt + 0.25%	40	35
Reglone + Metribuzin + NIS	1.5 pt + 0.25 lb + 0.25%	77	71
Roundup + AMS	22 oz + 2.5 gal	76	72
Metribuzin[b]	0.25 lb	20	17

[b]Applied with AMS + MSO

May 29
3” kochia
63 F

Minot 2020

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May 29
3” kochia
63 F

[b]Applied with AMS + MSO

Minot 2020

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[b]Applied with AMS + MSO

May 29
3” kochia
63 F

Use multiple modes of action to control kochia

Spartan Charge + Roundup*
Sharpen + Roundup*

Gramoxone
Gramoxone + Sharpen
Gramoxone + Metribuzin
Gramoxone + Spartan Charge

Spartan Charge + Gramoxone
Spartan Charge + Liberty

Dicamba (some labels specify 3 days/oz prior to wheat)

Kochia control with spring-applied burndown herbicides (2021)

			Kochia		Colq	
Treatment[ab]	Rate	Timing	Jun 2	Jun 18	Jun 2	Jun 10
	(oz)	May 26	----------%----------			
Untreated			0	0	0	0
Sharpen	1		55	28	99	99
Gramoxone	40		97	92	96	91
Reviton	1		42	23	98	99
Reviton	2		47	27	99	99
LSD			5.7	8.9	1.7	4.5

[a] Treatments applied May 26. Kochia 0.5-2", Colq 0.5-3"

[b] Sharpen and Reviton applied with AMS + MSO. Gramoxone 2SL applied with AMS + COC.

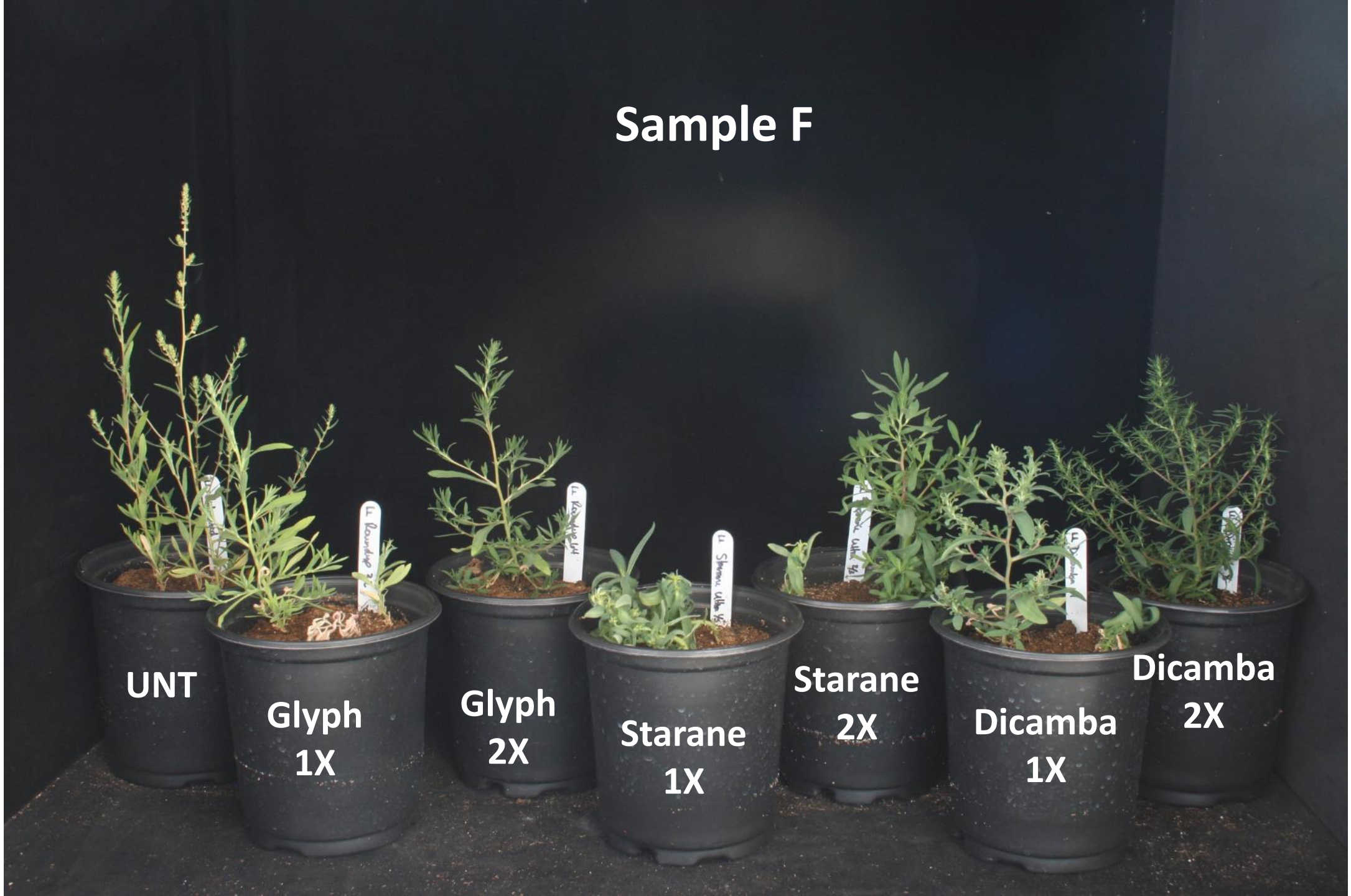
Starane 2x

Equivalent to 2.67 pt WideMatch

Photo: 16 DAT

2015

Kochia regrowth following Starane Ultra application


Sample F
UNT
Glyph 1X
Glyph 2X
Starane 1X
Starane 2X
Dicamba 1X
Dicamba 2X

Consider POST wheat products that have multiple modes of action:

Huskie FX: (pyrasulfatole + bromoxynil + fluroxypyr)

Talinor + Starane: (bicyclopyrone + bromoxynil + fluroxypyr)

Kochiavore/Cleansweep: (2,4-D + bromoxynil + fluroxypyr)

Batalium Amped: Everest + bromoxynil + fluroxypyr

Broadleaf weed control in wheat with Huskie FX (2021)

Table. Broadleaf weed control in wheat with Huskie FX. (2134)

		Weed Control		
		Kochia		
Treatment[a]	Rate	Jun-23	Jul-9	Jul-29
		----------%----------		
Untreated		0	0	0
Huskie FX	15.5 oz	94	91	82
Huskie FX	18 oz	97	95	87
WideMatch + MCPA ester	16 oz + 8 oz	75	75	70
Talinor + CoAct+	13.7 oz + 2.75 oz	88	75	72
Bronate	16 oz	62	57	58
LSD (0.05)		3.2	7.8	9.9

[a] *Applied to 0.5-9 inch kochia*

Broadleaf weed control in wheat with Huskie FX (2022)

Table. Kochia control in wheat with Huskie FX. (2234)

		Wheat injury		Kochia		Lambsquarters	
Treatment[a]	Rate	22-Jun	11-Jul	22-Jun	11-Jul	22-Jun	11-Jul
		--------%--------		----------% control----------			
Untreated		0	0	0	0	0	0
Huskie FX	15.5 oz	0	0	92	95	100	100
Huskie FX	18 oz	0	0	96	97	100	100
Talinor + CoAct+	13.7 oz + 2.75 oz	0	0	91	92	100	100
Bronate	16 oz	0	0	80	77	100	100
WideARMatch + MCPA Ester	14 oz + 8 oz	0	0	84	80	100	100
LSD (0.05)		NS	NS	6.7	6.9	1	1

[a]*All treatments applied to 2-inch kochia*

Untreated

Fall Valor

Kochia control with fall-applied herbicides (2021)

Treatment[ab]	Rate	Timing	Kochia	Ruth
			Jun 7	Jun 7
			----------%----------	
Untreated			0	0
Glyphosate	32 oz	Fall	0	0
Gly + 2,4-D	32 oz + 1 pt	Fall	0	0
Gly + Clarity	32 oz + 4 oz	Fall	0	0
Gly + Sharpen	32 oz + 1 oz	Fall	0	0
Gly + Sharpen + 2,4-D	32 oz + 1 oz + 1 pt	Fall	0	0
Gly + Valor	32 oz + 3 oz	Fall	63	80
Gly + Valor + 2,4-D	32 oz + 3 oz + 1 pt	Fall	64	79
LSD				

[a] Treatments applied October 9, 2020.

[b] All Glyphosate treatments applied with AMS. Sharpen applied with MSO.

Kochia

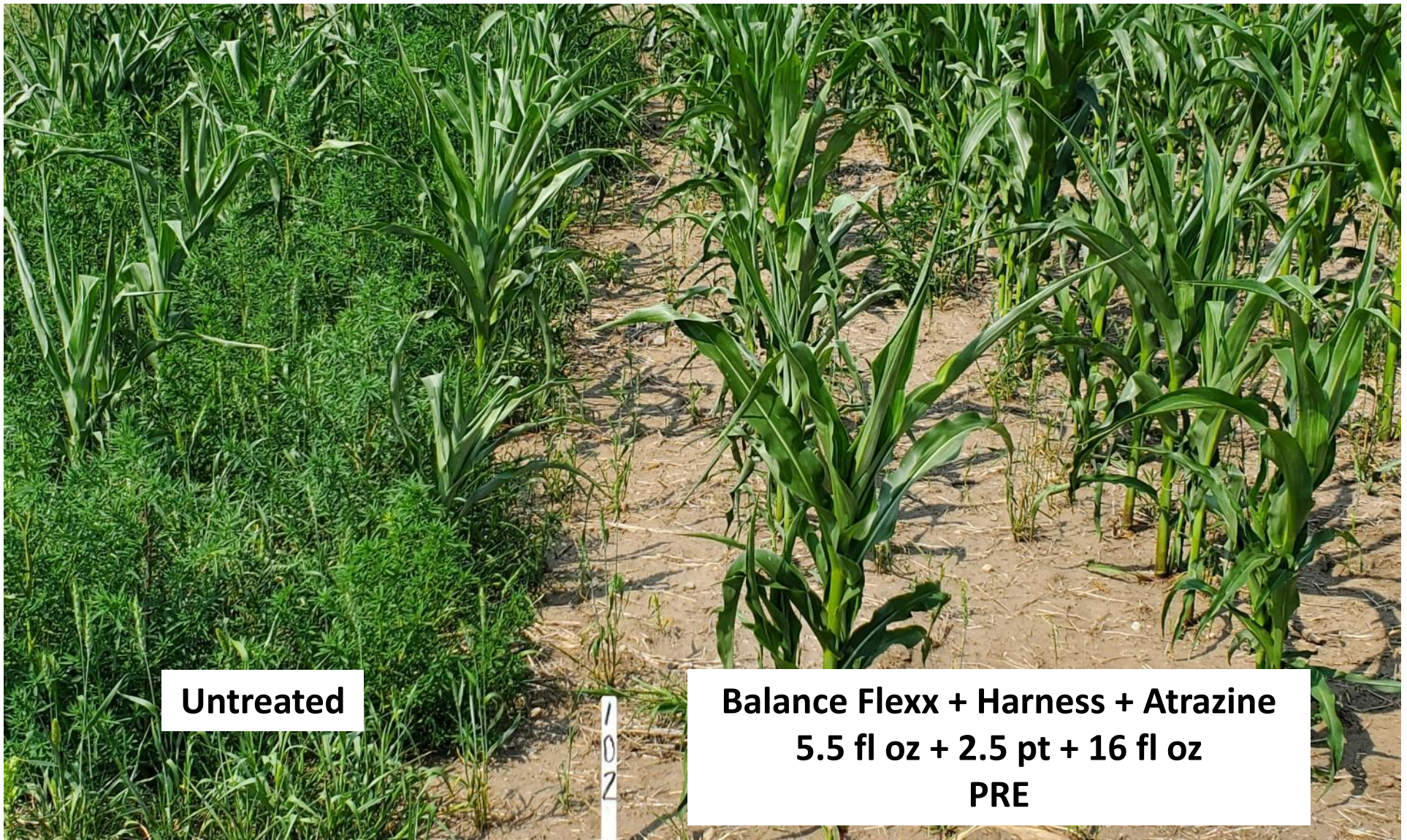
Valor + Metribuzin + 2,4-D

4 oz + 4 oz + 12 oz

Applied Nov 16, 2016

Picture June 5, 2017

Photo: Tom Gardner, Valent

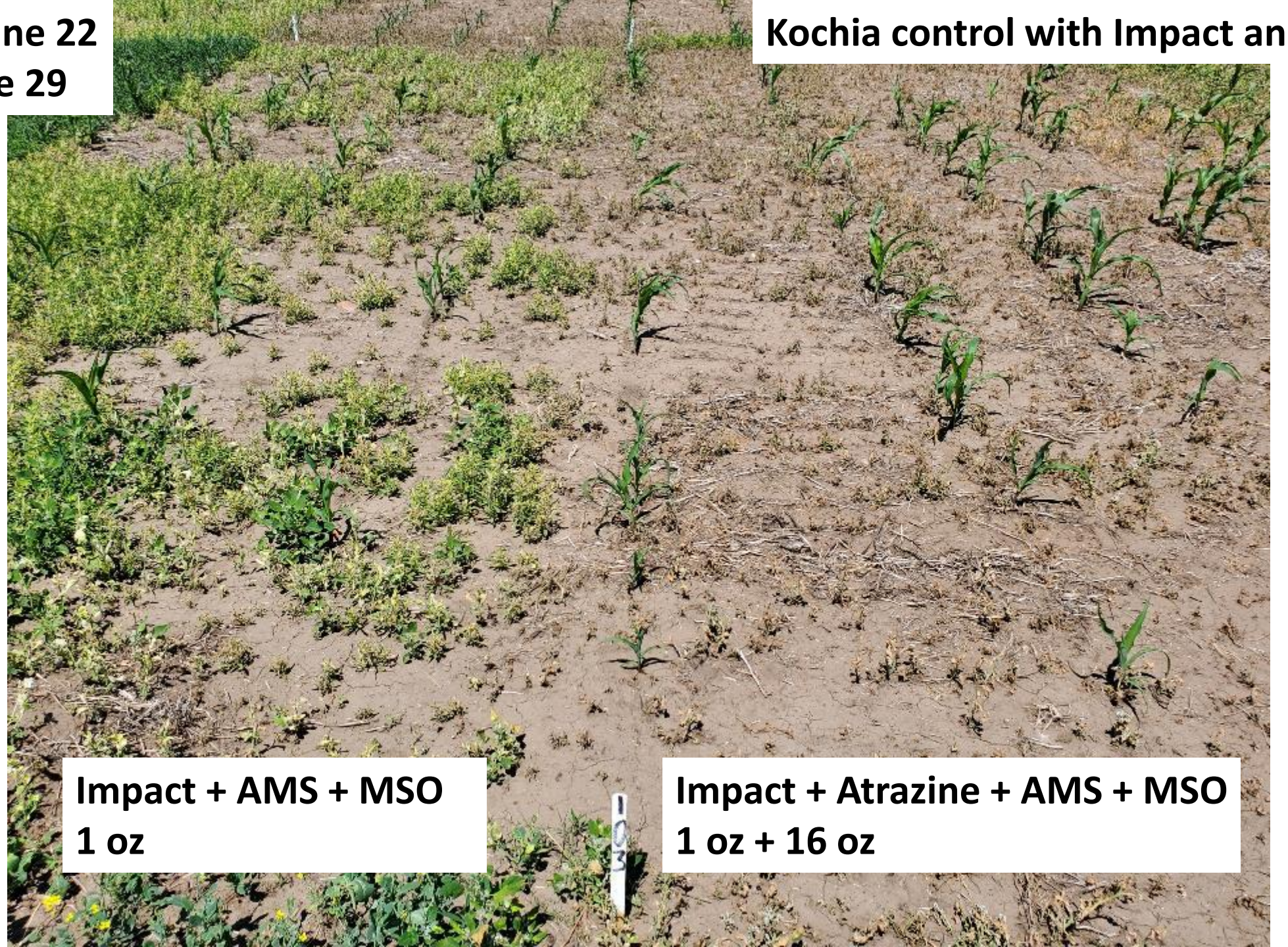


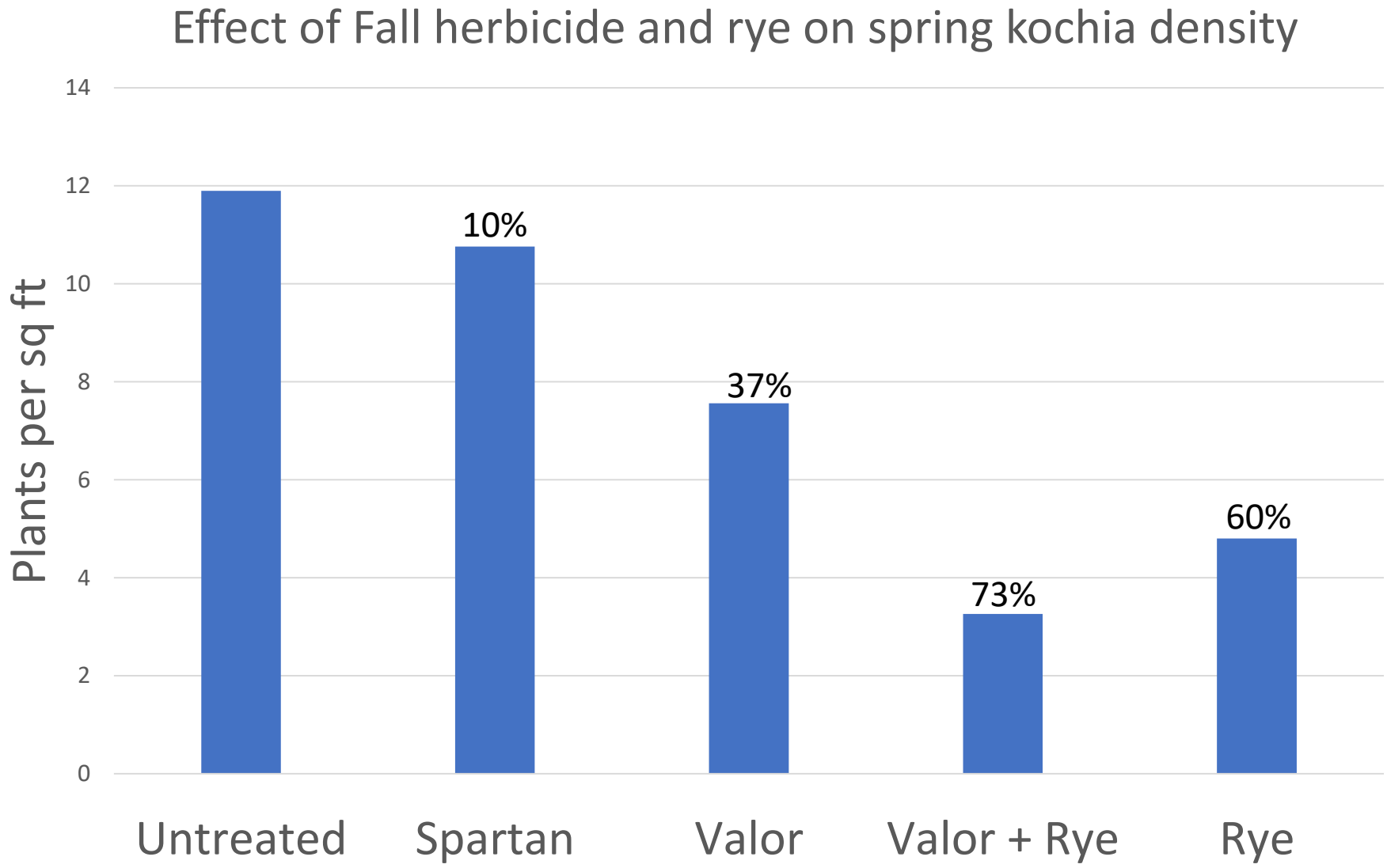
May 10: PRE
May 20: 0.17
May 21: 0.27
May 22: 0.12
May 23: 0.23
May 24: 0.15

Kocz
Colq
Prpw
Grft
Yeft

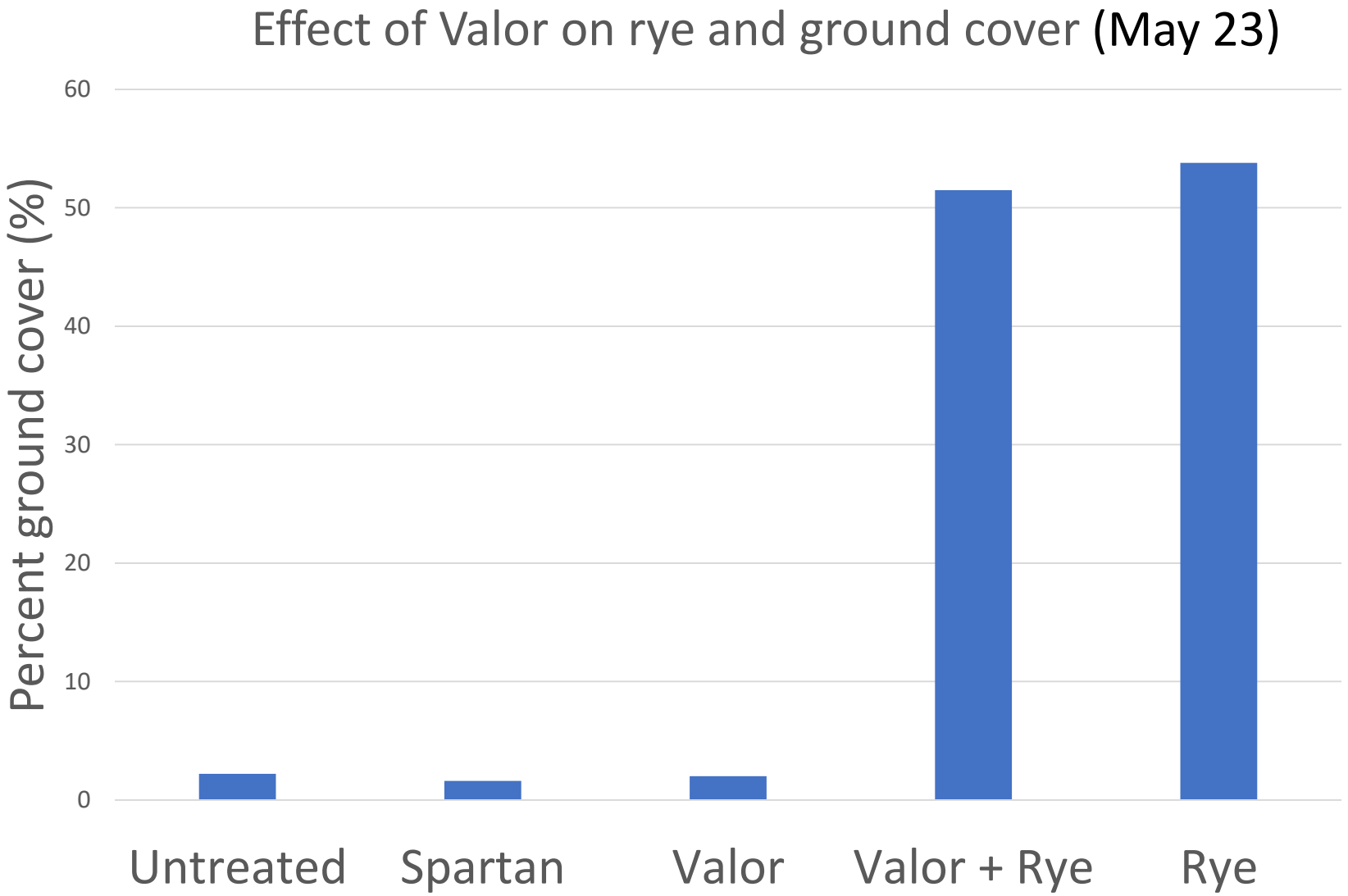
Applied: June 22
Photo: June 29

Kochia control with Impact and Atrazine

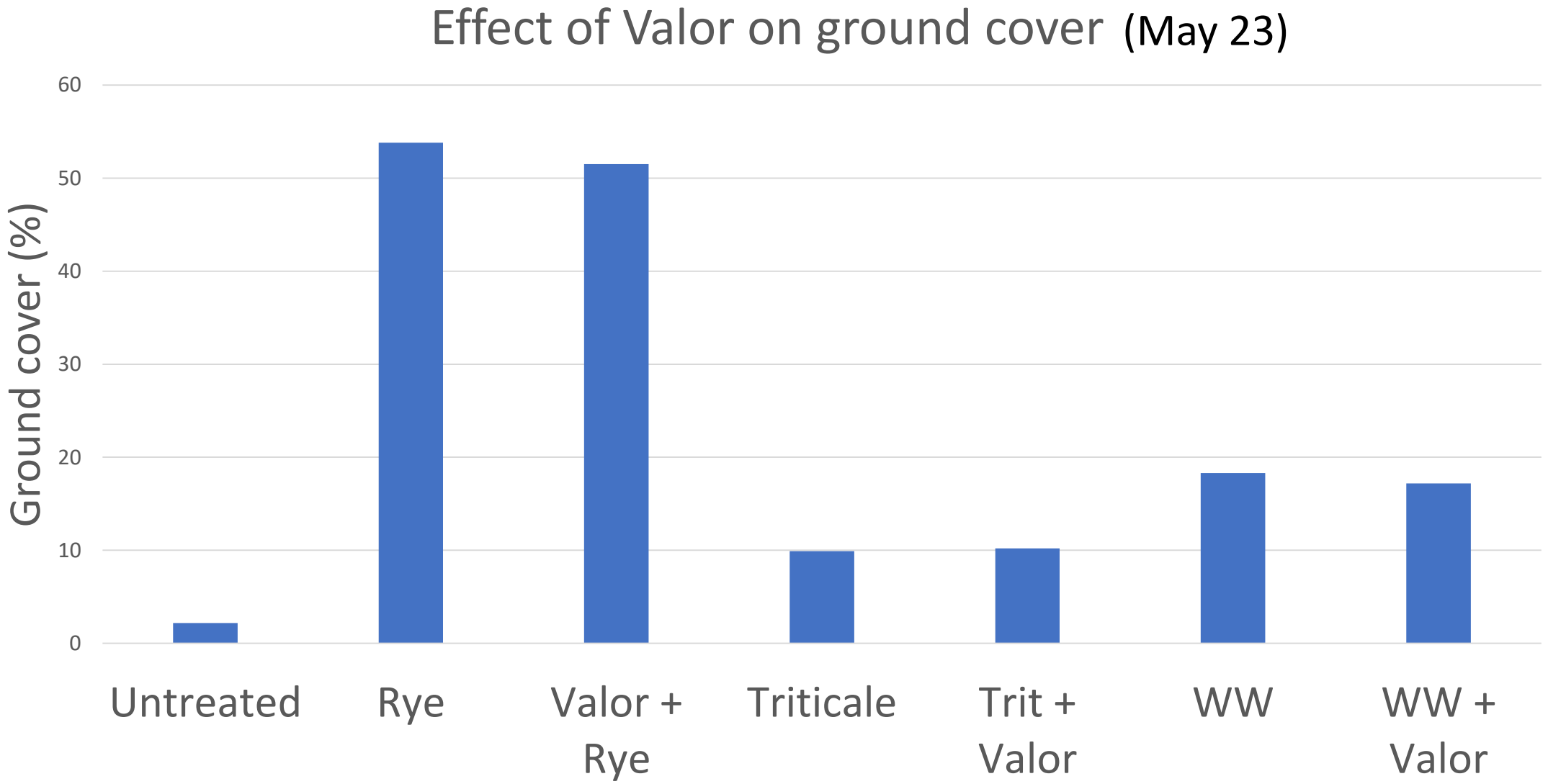




- Rye planted Sept 5, 2021 (30lb)
- Herbicides applied Oct 18, 2021
- Kochia density May 23, 2022


Effect of Valor on rye and ground cover (May 23)
Percent ground cover (%)
60
50
40
30
20
10
0
Untreated
Spartan
Valor
Valor + Rye
Rye

2203


Effect of Valor on ground cover (May 23)
Ground cover (%)
60
50
40
30
20
10
0
Untreated
Rye
Valor + Rye
Triticale
Trit + Valor
WW
WW + Valor

2203

Table 2. Kochia density and biomass and cover crop biomass in presence of kochia in fall- and spring-sown cover crop and fallow treatments in 2008 and 2009 at Garden City, KS.

Cover crop	Kochia density		Kochia biomass		Cover crop biomass		
	2008	2009	2008	2009	2008	2009	
	plants/ft^2		lb/acre				
Fall-sown							
Fallow (no-cover control)	20.4 a[†]	2.5 a	93.7 a	51.8 a	0 c	0 c	
Austrian winter pea	5.0 c	1.7 a-d	6.2 b	25.0 ab	1232 b	116 c	Frost
Austrian winter pea-Winter triticale	1.3 c	0.6 bcd	0.3 b	0.9 b	2910 a	3142 a	
Hairy vetch	10.0 b	2.2 abc	17.0 b	29.5 ab	1125 b	0 c	Frost
Hairy vetch-Winter triticale	2.9 c	0.5 cd	0.6 b	0.3 b	2740 a	2660 a	
Winter triticale	4.0 c	0.5 cd	0.9 b	0.3 b	1232 b	2615 a	

Petrosino et al. Crop, forage & turfgrass management

Wild oat and green foxtail resistance

Brian Jenks

North Dakota State University

Green foxtail resistance testing
(% resistant)

Herbicide	Group	2015-2020	2021
Puma	1	65	
Discover	1	67	
Axial XL	1	47	
Everest	2	13	
GoldSky	2	16	
Varro	2	17	
Raptor	2	0	
Assure II	1	45	
Select	1	3	
		n=118	n=21

*Samples not randomly collected

Green foxtail resistance testing
(% resistant)

Herbicide	Group	2015-2020	2021
Puma	1	65	86
Discover	1	67	71
Axial XL	1	47	81
Everest	2	13	24
GoldSky	2	16	24
Varro	2	17	19
Raptor	2	0	5
Assure II	1	45	76
Select	1	3	10
		n=118	n=21

*Samples not randomly collected

Wild oat resistance testing

(% resistant)

Herbicide	Group	2016-2020	2021
Puma	1	75	
Axial XL	1	39	
Everest	2	71	
GoldSky	2	71	
Varro	2	85	
Raptor	2	52	
Assure II	1	72	
Select	1	9	
		n=208	n=34

*Samples not randomly collected

Wild oat resistance testing

(% resistant)

Herbicide	Group	2016-2020	2021
Puma	1	75	88
Axial XL	1	39	35
Everest	2	71	85
GoldSky	2	71	53
Varro	2	85	91
Raptor	2	52	24
Assure II	1	72	82
Select	1	9	18
		n=208	n=34

25 of 34 resistant to both Puma and Everest

*Samples not randomly collected

Tough herbicide applied POST in chickpea

- Tough 5EC for broadleaf weed control
- Tough + COC (24 oz + 1-2.5% v/v)
- Label states that rates <24 oz may result in incomplete weed control (this is true)
- Do not exceed 24 oz per year
- 15 gpa water volume minimum
- Apply to small weeds (1-3 inches)
- Tough may be applied with a grass herbicide (e.g., clethodim)
- Best results achieved in sunny, warm, humid conditions
- Chickpea has shown excellent tolerance to Tough
- Use a PRE such as Spartan to reduce POST weed pressure. Do not rely solely on Tough.
- Current Tough price will severely limit use (~$30/A for 24 oz)

Tough herbicide labeled for Lentil

- Main label states that rates <24 oz may result in incomplete weed control (this is true)
- Supplemental label recommends 12-20 oz PRE, 6-20 oz POST for lentil
- Supplemental label allows tank mix with Metribuzin or grass herbicide

- Tech sheet recommends 7 oz Tough + 2 oz Metribuzin 75 DF applied at 3-5 node stage
- 20 gpa water volume
- **Expect significant chlorosis/necrosis 20-40% or more**
- Injury can be worse in cold, wet, cloudy conditions
- Lentils recover over time, especially with later rainfall (complete recovery? TBD)
- We have no independent data on weed control effectiveness or yield impact

- Do not exceed 20 oz per year
- Apply to small weeds (1-3 inches)
- Tough may be applied with a grass herbicide
- Best results achieved in sunny, warm, humid conditions