

# Weed Control Research Update in Western Kansas

Vipan Kumar, Ph.D.  
 Research Weed Scientist  
 Agricultural Research Center-Hays



# Research Topics Outline

- Update on herbicide-resistant Palmer amaranth and Kochia
- Herbicide strategies for Palmer control in corn, Enlist E3 soybean, sorghum, sunflower and wheat stubble
- Integrated weed management in western KS
  - Cover crops
  - Agronomic practices

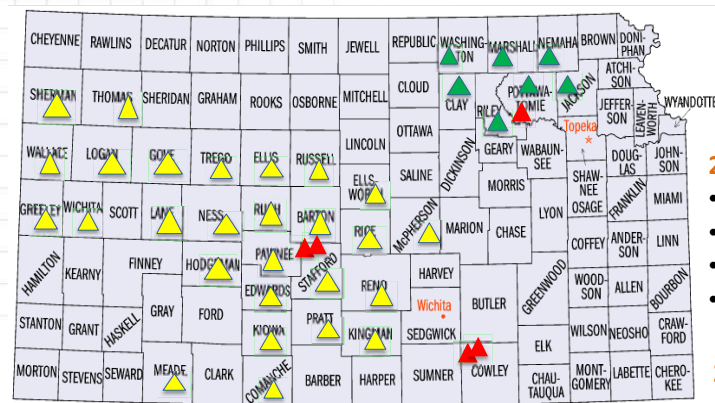
# Palmer amaranth

- Dioecious summer annual, emerge from late-spring through late-summer
- Aggressive growth (1 to 2 inch per day) & highly competitive
- Obligate outcrossing enhances genetic diversity and rapid adaptation
- Prolific seed producer (> 0.6 million seeds plant<sup>-1</sup>)



Chahal et al. 2015; Norsworthy et al. 2014; Ward et al. 2013

# Palmer amaranth Survey in Kansas



2014-2017 collections:

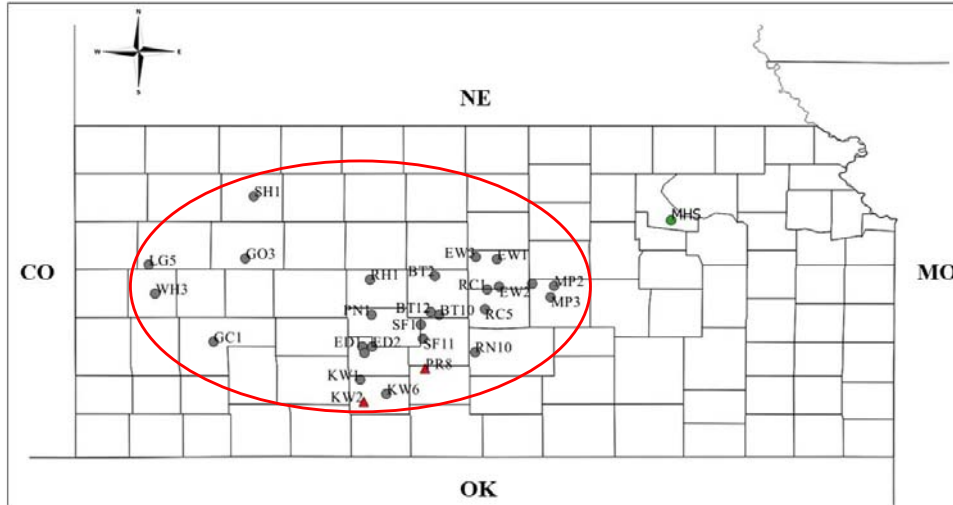
- Corn
- Soybean
- Sorghum
- Wheat stubble/fallow

2018 collections:

- Soybean

- ▲ = Glyphosate-Resistant Palmer amaranth in 2011
- ▲ = Samples collected in 2014-2017
- ▲ = Samples collected in 2018

# Herbicide Screening of Selected Palmer populations



# Objective

- ❖ Determine the sensitivity of selected Palmer amaranth populations to commonly used herbicides

Roundup, Glean, 2,4-D, Clarity, Atrazine and Callisto



# Discriminate-Dose Experiments

- ❖ 28 populations
- ❖ Grown in 4-by-4-in pots
- ❖ Sprayed 3 to 4-in tall plants in a spray chamber



Palmer amaranth seedlings grown in greenhouse at Hays, KS

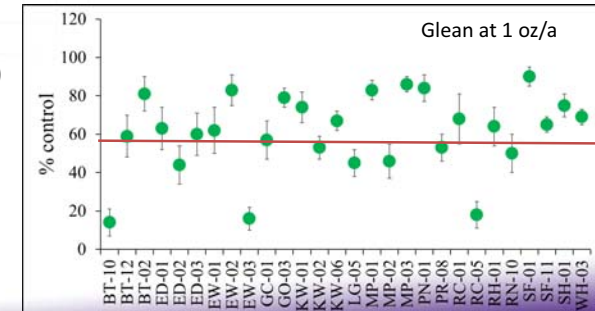
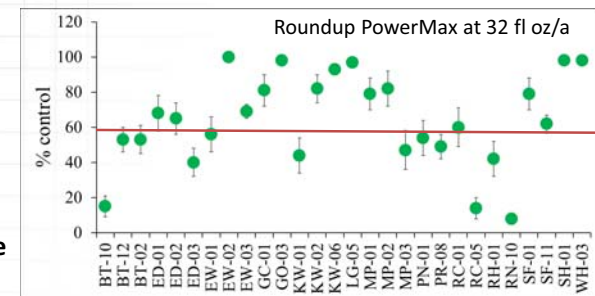
Herbicide*	1X rate (oz/a)
Roundup	32
Glean	1
Weedone	18
Clarity	16
AAtrex	32
Callisto	3

# Response to Roundup and Glean at 21 DAT

Less-sensitive  
(≤ 59% control)

Moderately sensitive  
(60 to 89% control)

Susceptible  
(90 to 100% control)

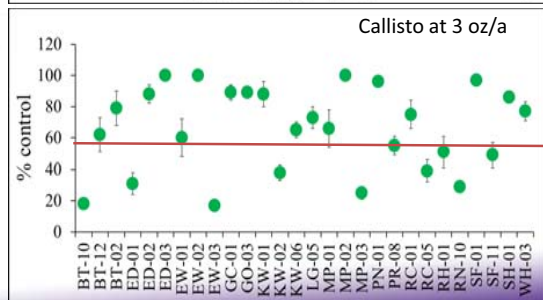
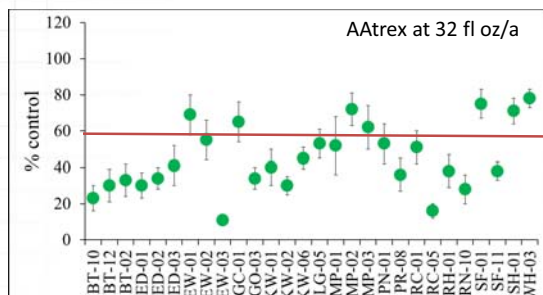


## Response to AAtrex and Callisto at 21 DAT

Less-sensitive  
( $\leq 59\%$  control)

Moderately sensitive  
(60 to 89% control)

Susceptible  
(90 to 100% control)

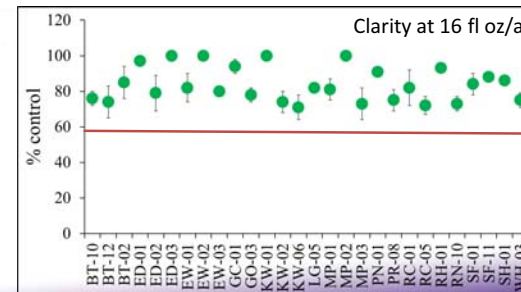
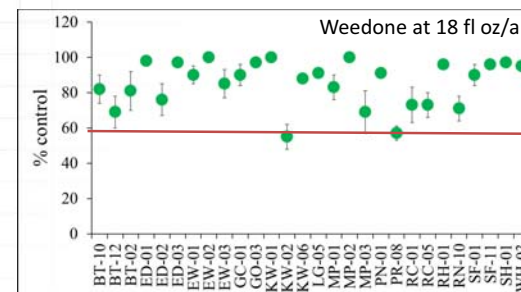


## Response to Weedone and Clarity at 21 DAT

Less-sensitive  
( $\leq 59\%$  control)

Moderately sensitive  
(60 to 89% control)

Susceptible  
(90 to 100% control)



## Multiple Resistant Palmer amaranth in KS

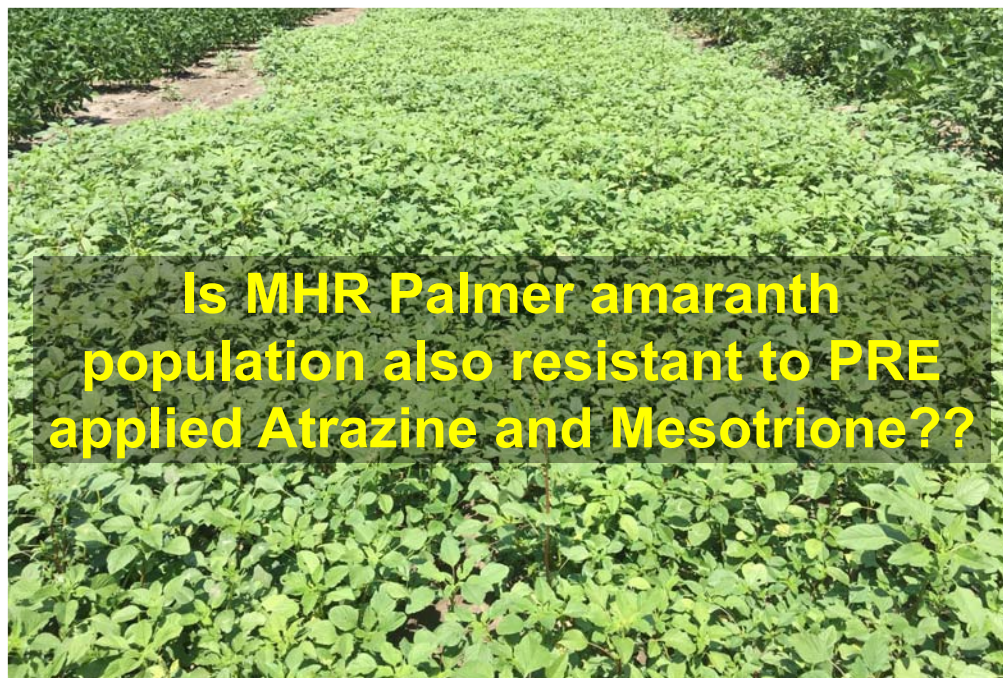
A single Palmer amaranth population from central Kansas recently confirmed with multiple resistance to five herbicide site(s) of action:

- ✓ 2,4-D (3.2-fold)
- ✓ Roundup (12-fold)
- ✓ Glean (5-fold)
- ✓ AAtrex (14-fold)
- ✓ Callisto (13-fold)

Reduced sensitivity to PPO inhibitors



2,4-D survived Palmer amaranth plant producing seeds in greenhouse



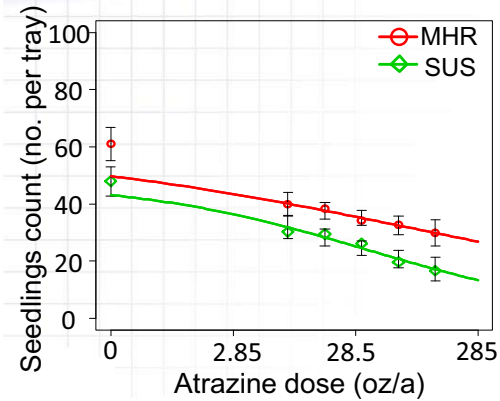
## PRE Atrazine and Mesotrione Dose-Response

- MHR and SUS population
- Germination trays filled with field soil
- 150 seeds from each population per tray
- Design: RCBD and 4 reps

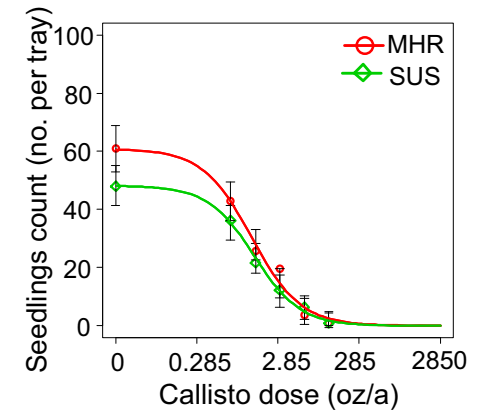


Herbicide*	1X rate (oz/a)	Doses
AAtrex	32	0, 0.25, 0.5, 1, and 2 X
Mesotrione	3	

## PRE Atrazine and Mesotrione Dose-Response

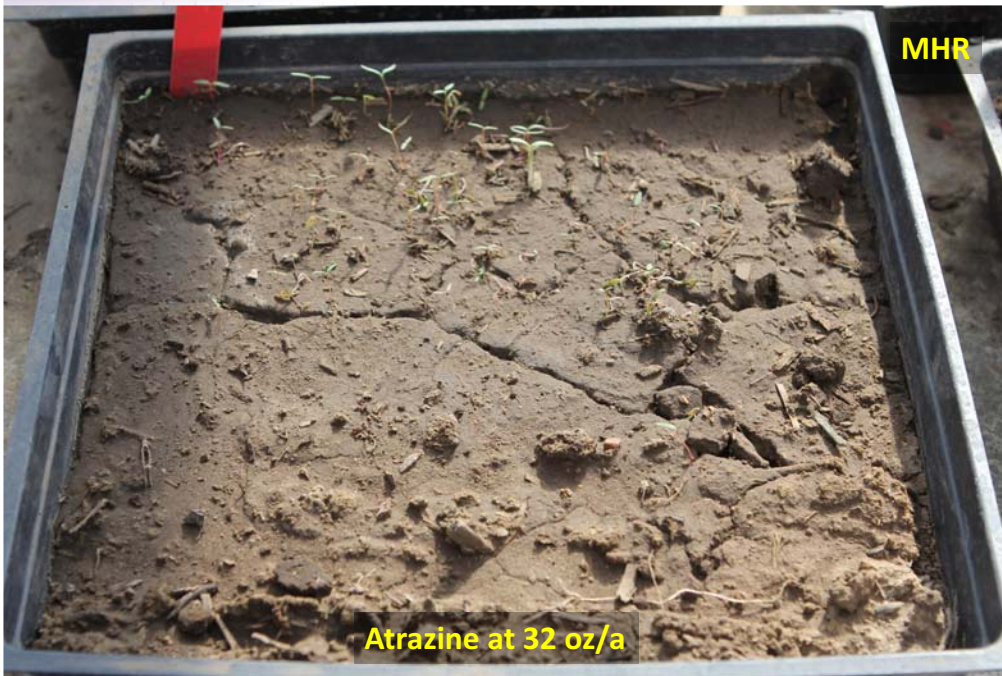


Pop	ED <sub>50</sub> (oz/a)	R/S
MHR	109	3.0
SUS	36	-



Pop	ED <sub>50</sub> (oz/a)	R/S
MHR	1.4	1.07
SUS	1.3	-

## Response of MHR and SUS to PRE Atrazine



How are we going to manage this MHR Palmer amaranth in Kansas??



## Overlapping Residuals for Controlling MHR Palmer in Corn

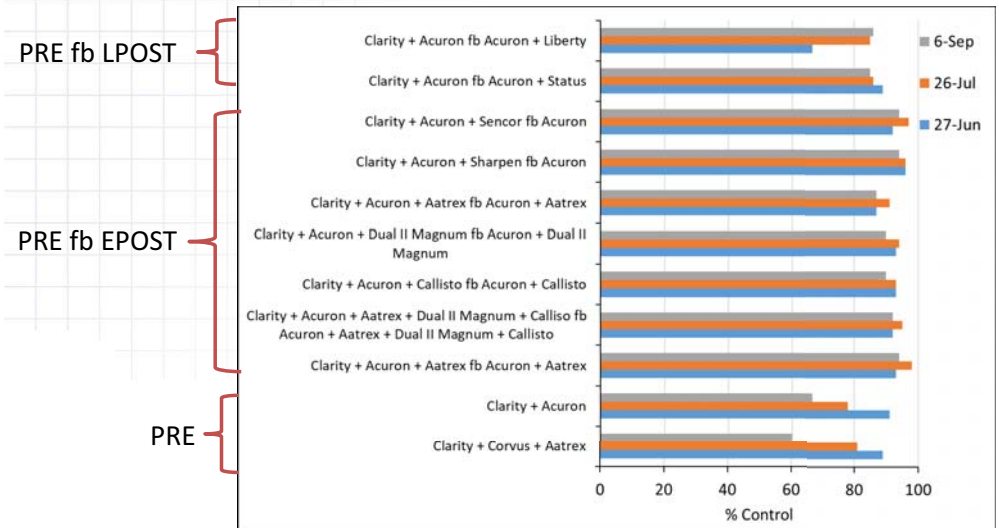
Trt	Herbicide Programs <sup>1,2,3</sup>	Rate (oz/A)	Timing
1	Nontreated		
2	Clarity + Corvus + Aatrex	8 + 5.6 + 24	PRE
3	Clarity + Acuron	8 + 96	PRE
4	Clarity + Acuron + Aatrex fb Acuron + Aatrex	8 + 48 + 8 fb 48 + 8	PRE fb EPOST
5	Clarity + Acuron + Aatrex + Dual II Magnum + Callisto fb Acuron + Aatrex + Dual II Magnum + Callisto	8+ 48 + 8 + 8 + 1 fb 48 + 8 + 8 + 1	PRE fb EPOST
6	Clarity + Acuron + Callisto fb Acuron + Callisto	8 + 64 + 1 fb 32 + 1	PRE fb EPOST
7	Clarity + Acuron + Dual II Magnum fb Acuron + Dual II Magnum	8 + 64 + 8 fb 32 + 8	PRE fb EPOST
8	Clarity + Acuron + Aatrex fb Acuron+ Aatrex	8 + 64 + 8 fb 32 + 8	PRE fb EPOST
9	Clarity + Acuron + Sharpen fb Acuron	8 + 64 + 2.5 fb 32	PRE fb EPOST
10	Clarity + Acuron + Sencor fb Acuron	8 + 48 + 3 fb 48	PRE fb EPOST
11	Clarity + Acuron fb Acuron + Status	8 + 48 fb 48 + 2.5	PRE fb LPOST
12	Clarity + Acuron fb Acuron + Liberty	8 + 48 fb 48 + 22	PRE fb LPOST



<sup>1</sup>All PRE and POST treatments were applied with Roundup at 27 oz/a  
<sup>2</sup>PRE treatments were applied on June 6; EPOST on June 27 and LPOST on July 11  
<sup>3</sup>Herbicide treatments were applied with adjuvants as dictated by each label

Knowledge  
forLife

## MHR Palmer Amaranth Control in Corn



Knowledge  
forLife



Untreated



Knowledge  
forLife



Clarity + Acuron + Aatrex  
fb Acuron + Aatrex



Knowledge  
forLife

## MHR Palmer amaranth Control in Enlist Corn

Herbicide <sup>1, 2, 3</sup>	Rate, oz/A	Jun 26	Jul 29	Aug 29	Yield (bu/a)
Surestart + Atrazine 4L <i>fb</i> Enlist One + Realm Q + Liberty	64 + 32 <i>fb</i> 32 + 4 + 32	95 bcd	95 bcd	91 bc	104 a
Resicore + Atrazine 4L <i>fb</i> Enlist + Dual Magnum + Liberty	40 + 32 <i>fb</i> 32 + 16 + 32	96 abc	98 ab	97 ab	106 a
Fulltime NXT <i>fb</i> Enlist + Corvus + Liberty	80 <i>fb</i> 32 + 5.6 + 32	99 a	100 ab	100 a	103 a
Anthem Maxx + Atrazine 4L <i>fb</i> Enlist + Corvus + Liberty	4 + 32 <i>fb</i> 32 + 64 + 32	98 ab	96 abc	95 abc	107 a
Acuron <i>fb</i> Enlist + Liberty	80 <i>fb</i> 32 + 32	96 abc	97 abc	94 abc	105 a
Harness Max <i>fb</i> Enlist + Liberty	40 <i>fb</i> 32 + 32	93 cde	91 de	91 bcd	104 a
Keystone NXT <i>fb</i> Enlist + Liberty	56 <i>fb</i> 32 + 32	96 abc	96 abc	93 abc	104 a
Harness Xtra <i>fb</i> Enlist + Liberty	56 <i>fb</i> 32 + 32	96 abc	95 bcd	93 abc	104 a
Armezon PRO + Atrazine 4L <i>fb</i> Enlist + Liberty	20 + 32 <i>fb</i> 32 + 32	91 de	92 cd	90 cd	104 a
Enlist + Liberty <i>fb</i> Enlist + Liberty	32 + 32 <i>fb</i> 32 + 32	90 e	87 e	85 d	100 a



<sup>1</sup>All PRE *fb* POST programs included Roundup PowerMax at 32 fl oz/a  
<sup>2</sup>PRE treatments were applied on May 17 and POST were applied on June 13  
<sup>3</sup>Appropriate adjuvants were included as dictated by each herbicide label

Knowledge  
forLife



## MHR Palmer amaranth Control in Enlist Soybean

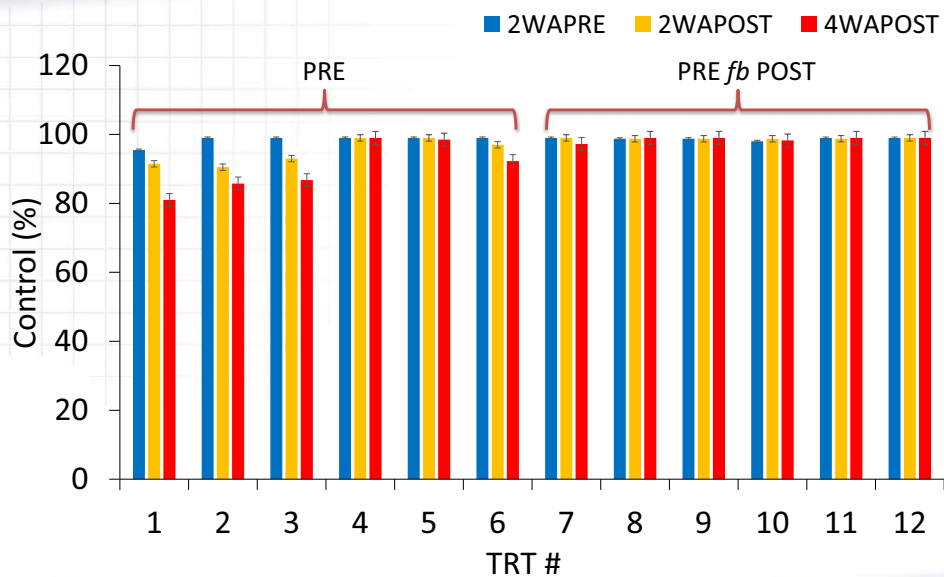
Trt	Herbicide <sup>1, 2</sup>	Rate, oz/A	Timing
1	Sonic	5	PRE
2	Trivence	8	PRE
3	Authority Supreme	10	PRE
4	Authority MTZ	14	PRE
5	Panther PRO	12	PRE
6	Fierce XLT	3.75	PRE
7	Sonic <i>fb</i> Enlist + Durango + Liberty	5 <i>fb</i> 32+32+32	PRE <i>fb</i> POST
8	Trivence <i>fb</i> Enlist + Durango + Liberty	8 <i>fb</i> 32+32+32	PRE <i>fb</i> POST
9	Authority Supreme <i>fb</i> Enlist + Durango + Liberty	10 <i>fb</i> 32+32+32	PRE <i>fb</i> POST
10	Authority MTZ <i>fb</i> Enlist + Durango + Liberty	14 <i>fb</i> 32+32+32	PRE <i>fb</i> POST
11	Panther PRO <i>fb</i> Enlist + Durango + Liberty	12 <i>fb</i> 32+32+32	PRE <i>fb</i> POST
12	Fierce XLT <i>fb</i> Enlist + Durango + Liberty	3.75 <i>fb</i> 32+32+32	PRE <i>fb</i> POST

<sup>1</sup>PRE treatments were applied on June 5 and POST were applied on July 3  
<sup>2</sup>Appropriate adjuvants were included as dictated by each herbicide label

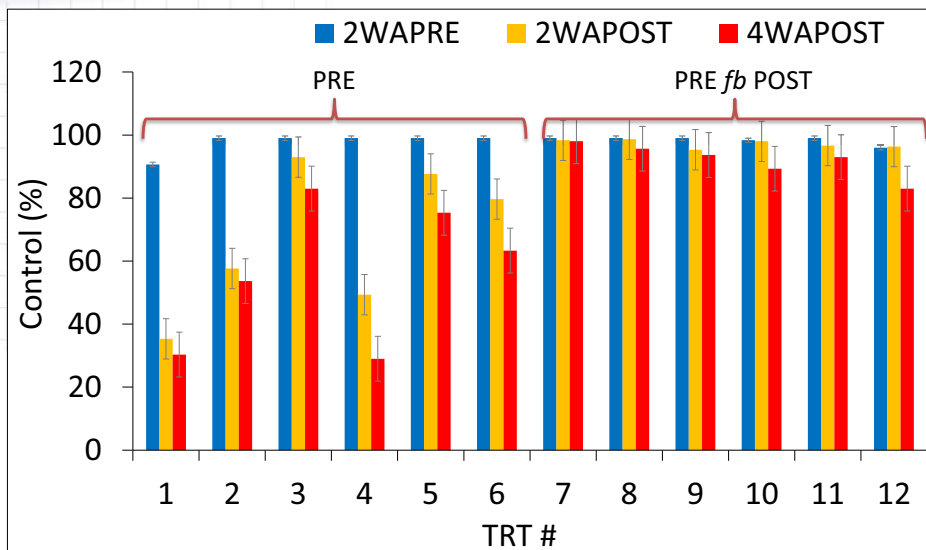


Knowledge  
forLife

## MHR Palmer amaranth Control at Hays



## MHR Palmer amaranth Control near Great Bend



Great Bend, Aug 5



Nontreated

Great Bend, Aug 5



Trivence fb  
Enlist + Durango + Liberty

## Managing Palmer amaranth in Sorghum



## POST Options in Grain Sorghum

Trt	Herbicide <sup>1,2,3</sup>	Rate, oz/A	Timing(s)
1	Coyote + Atrazine fb Weedar 64	64 + 24 fb 8	PRE fb EPOST
2	Lumax EZ fb Weedar 64	86 fb 8	PRE fb EPOST
3	Degree Xtra	72	PRE
4	Dual Magnum fb Dual Magnum	24 fb 16	PRE fb LPOST
5	Atrazine	32	EPOST
6	Atrazine + Clarity	32 + 2	EPOST
7	Atrazine + Clarity	32 + 4	EPOST
8	Clarity	8	EPOST
9	Huskie	13	EPOST
10	Huskie + Clarity	13 + 4	EPOST
11	Huskie + Atrazine	13 + 16	EPOST
12	Huskie + Atrazine	13 + 16	LPOST
13	Moxy + Atrazine + Clarity	16 + 16 + 2	LPOST

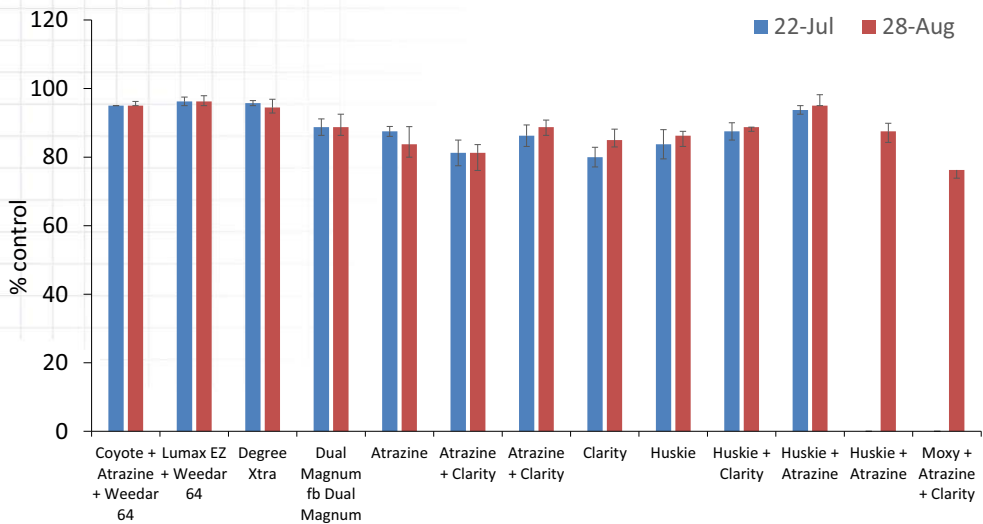
<sup>1</sup> PRE treatments were applied on June 13

<sup>2</sup> EPOST treatments were applied on July 10

<sup>3</sup> LPOST treatments were applied on July 23



# POST Options in Grain Sorghum



Knowledge for Life



Untreated

Knowledge for Life



Aug 28



Lumax EZ PRE fb Weedar 64 EPOST

Knowledge for Life



Atrazine (32 oz) + Clarity (4 oz)-EPOST

Knowledge for Life



## Herbicide Options in Wheat Stubble

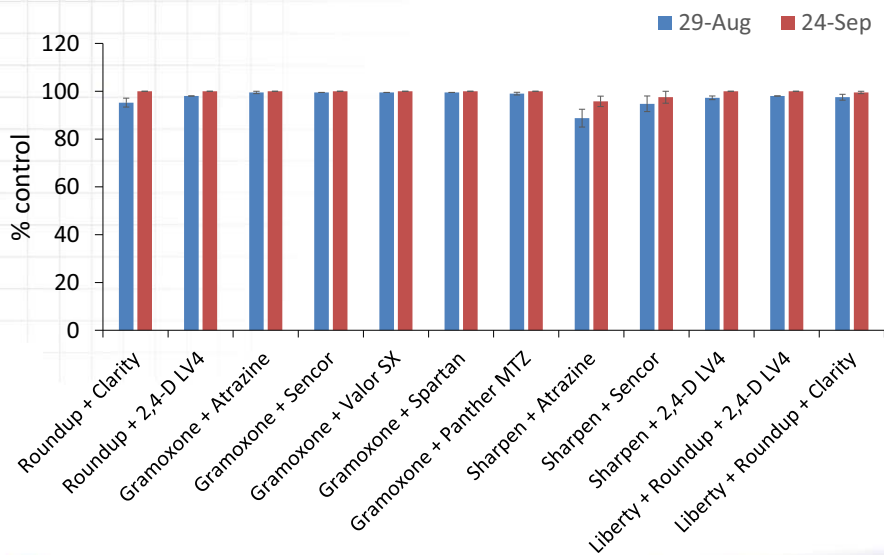
Trt	Herbicide *	Rate, oz/A
1	Roundup PowerMax + Clarity	32 + 16 + 2% AMS
2	Roundup PowerMax + 2,4-D LV4	32 + 32 + 2% AMS
3	Gramoxone + Atrazine	48 + 16 + 1% COC
4	Gramoxone + Sencor	48 + 5 + 1% COC
5	Gramoxone + Valor SX	48 + 2 + 1% COC
6	Gramoxone + Spartan	48 + 4 + 1% COC
7	Gramoxone + Panther MTZ	48 + 15 + 1% COC
8	Sharpen + Atrazine	2 + 16 + 1% MSO + 2% AMS
9	Sharpen + Sencor	2 + 5 + 1% MSO + 2% AMS
10	Sharpen + 2,4-D LV4	2 + 32 + 1% MSO + 2% AMS
11	Liberty + Roundup PowerMax + 2,4-D LV4	36 + 32 + 32 + 1.5 lbs/a AMS
12	Liberty + Roundup PowerMax + Clarity	36 + 32 + 16 + 1.5 lbs/a AMS



\* All treatments were applied on Aug 2 (Palmer plants were 2 to 3 feet tall and had initiated flowering)

Knowledge forLife

## Palmer amaranth Control in Wheat Stubble



Knowledge forLife



Knowledge forLife

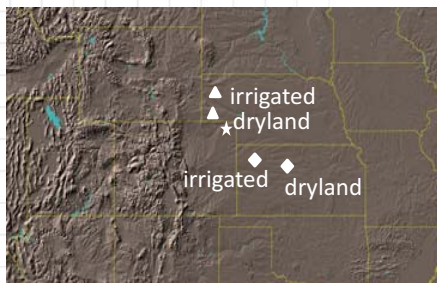


Hays, Sept 24

## Efficacy of PRE Herbicides followed by Zidua POST for Controlling Glyphosate-Resistant Weeds in Sunflower

Vipan Kumar and Jeanne Falk Jones

### Palmer Control in Sunflower



- **Locations:** Hays, Colby, Scottsbluff, Sidney, Julesburg
- **Years:** 2018 and 2019
- **Planting:** mid June to early July
- **Variety:** locally adapted
- **Seeding rates:** 18,000 to 22,000 seeds/ac
- **Design:** RCBD with 4 reps



### Herbicide Programs Investigated

Trt	Herbicide <sup>1,2</sup>	Rate, oz/A	Timing
1	Prowl H <sub>2</sub> O	32	PRE
2	Prowl H <sub>2</sub> O fb Zidua	32 fb 1.5	PRE fb EPOST
3	Prowl H <sub>2</sub> O fb Zidua	32 fb 1.5	PRE fb MPOST
4	Prowl H <sub>2</sub> O fb Zidua	32 fb 1.5	PRE fb LPOST
5	Broadaxe	19-25	PRE
6	Broadaxe fb Zidua	19-25 fb 1.5	PRE fb EPOST
7	Broadaxe fb Zidua	19-25 fb 1.5	PRE fb MPOST
8	Broadaxe fb Zidua	19-25 fb 1.5	PRE fb LPOST
9	Spartan Charge	3 to 5	PRE
10	Spartan Charge fb Zidua	3 to 5 fb 1.5	PRE fb EPOST
11	Spartan Charge fb Zidua	3 to 5 fb 1.5	PRE fb MPOST
12	Spartan Charge fb Zidua	3 to 5 fb 1.5	PRE fb LPOST
13	Hand weeded check	-	-
14	Nontreated weedy check	-	-

<sup>1</sup> Abbreviations: fb, followed by; PRE, pre-crop emergence; EPOST, early postemergence; MPOST, mid postemergence; LPOST, late postemergence  
<sup>2</sup> All treatments included glyphosate or gramoxone as PRE burndown

# Hays-2019

Herbicide (s)	Timing	Rate (oz/a)	July-12		Aug-16		Sep-10		Density (plants per 30 ft row)	
			Palmer amaranth	Kochia	Palmer amaranth	Kochia	Palmer amaranth	Kochia	Palmer amaranth	Kochia
Prowl H <sub>2</sub> O	PRE	32	94 ab	96 a	93 ab	94 a	92 ab	94 a	4	1
Prowl H <sub>2</sub> O fb Zidua	PRE fb EPOST	32 fb 1.5	98 a	94 a	98 a	92 ab	96 a	91 ab	2	1
Prowl H <sub>2</sub> O fb Zidua	PRE fb MPOST	32 fb 1.5	92 ab	95 a	92 ab	94 a	92 ab	93 ab	1	1
Prowl H <sub>2</sub> O fb Zidua	PRE fb LPOST	32 fb 1.5	94 ab	92 ab	94 a	91 ab	93 ab	91 ab	3	2
Broadaxe	PRE	25	98 a	98 a	99 a	99 a	99 a	99 a	0	0
Broadaxe fb Zidua	PRE fb EPOST	25 fb 1.5	96 a	99 a	98 a	99 a	98 a	98 a	0	0
Broadaxe fb Zidua	PRE fb MPOST	25 fb 1.5	97 a	98 a	99 a	98 a	99 a	99 a	0	0
Broadaxe fb Zidua	PRE fb LPOST	25 fb 1.5	96 a	99 a	99 a	98 a	99 a	98 a	0	0
Spartan Charge	PRE	5	87 b	89 b	85 b	86 b	85 b	82 b	5	2
Spartan Charge fb Zidua	PRE fb EPOST	5 fb 1.5	89 b	91 b	88 b	88 b	87 b	86 b	4	2
Spartan Charge fb Zidua	PRE fb MPOST	5 fb 1.5	86 b	88 b	85 b	85 b	84 b	83 b	6	3
Spartan Charge fb Zidua	PRE fb LPOST	5 fb 1.5	83 b	86 b	82 b	84 b	82 b	82 b	5	3
Hand weeded	-	-	100 a	100 a	100 a	100 a	100 a	100 a	0	0
Nontreated check	-	-	-	-	-	-	-	-	10	7



## Integrating Cover Crops and Herbicides for Weed Control in Xtend Soybeans

Isaac Effertz & Vipin Kumar

## Experimental Setup



- **Location:** Hays & Great Bend (GB)
- **Cover crops:**  
Wheat (Hays) & cereal rye (GB)
- **CC termination timings:**  
April 15, May 1, and May 17
- **Soybean planting:** June 06, 2019
- **Herbicides:** 7 programs
- **Design:** split-plot with 4 reps

## Herbicide Programs Investigated

Herbicide (s)	Rate (oz/a)	Timing
Roundup PowerMax (RuPM)	32	Preplant
RuPM + Authority Supreme	32 + 8	Preplant
RuPM + Panther MTZ	32 + 20	Preplant
RuPM + Fierce XLT	32 + 3.75	Preplant
RuPM + Authority Supreme <i>fb</i> RuPM + Xtendimax	32 + 8 <i>fb</i> 32 + 22	Preplant <i>fb</i> POST
RuPM + Panther MTZ <i>fb</i> RuPM + Xtendimax	32 + 20 <i>fb</i> 32 + 22	Preplant <i>fb</i> POST
RuPM + Fierce XLT <i>fb</i> RuPM + Xtendimax	32 + 3.75 <i>fb</i> 32 + 22	Preplant <i>fb</i> POST

## Cover Crop Biomass at Each Termination

### Cereal Rye at Great Bend

Cover Crop Termination	Biomass (lbs/ac)
First termination (April 15)	889
Second termination (May 1)	2070
Third termination (May 17)	2204

### Winter Wheat at Hays

Cover Crop Termination	Biomass (lbs/ac)
First termination (April 15)	880
Second termination (May 1)	1040
Third termination (May 17)	1796



Cereal Rye growth at second termination

## Effect of Herbicide Programs on Palmer density, Biomass and Soybean Yield at Great Bend

Herbicide	Palmer density (no. m <sup>-2</sup> )	Palmer biomass (g m <sup>-2</sup> )	Grain yield (bu ac <sup>-1</sup> )
Roundup PowerMax (RuPM)	36 a	133 a	38 c
RuPM + Authority Supreme	34 ab	103 ab	52 ab
RuPM + Panther MTZ	35 a	105 ab	48 b
RuPM + Fierce XLT	31 b	118 a	52 ab
RuPM + Authority Supreme <i>fb</i> RuPM + Xtendimax	9 c	41 c	55 ab
RuPM + Panther MTZ <i>fb</i> RuPM + Xtendimax	11 c	66 bc	54 ab
RuPM + Fierce XLT <i>fb</i> RuPM + Xtendimax	10 c	29 c	58 a

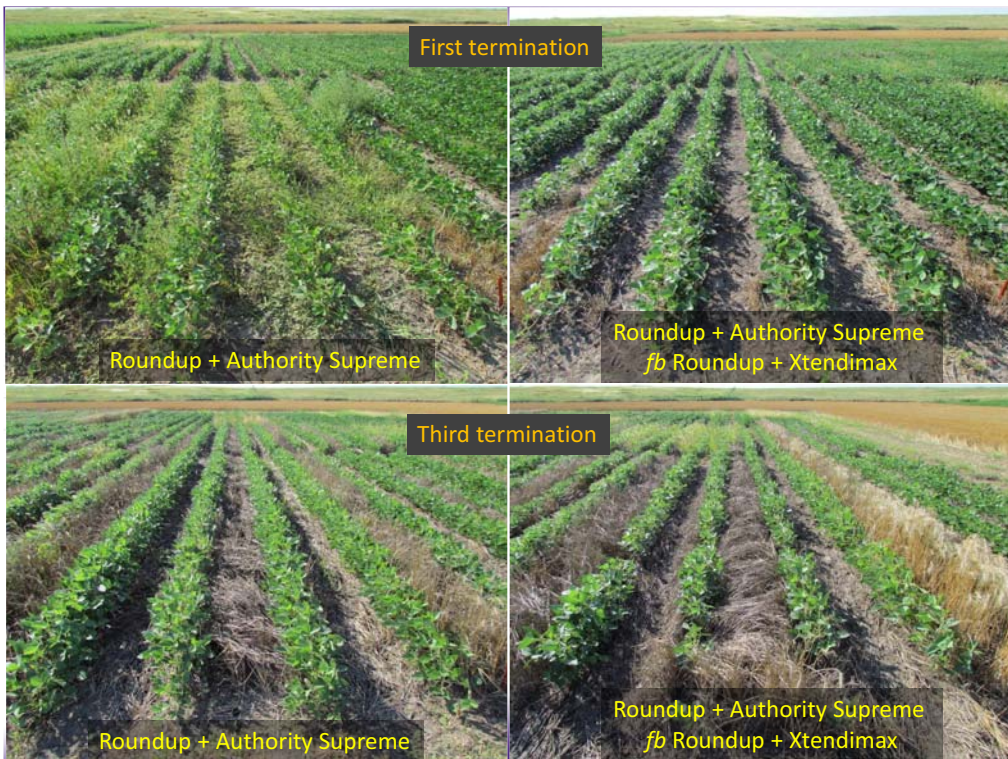


## Effect of Herbicide Programs on Total Weed Biomass and Soybean Yield at Hays

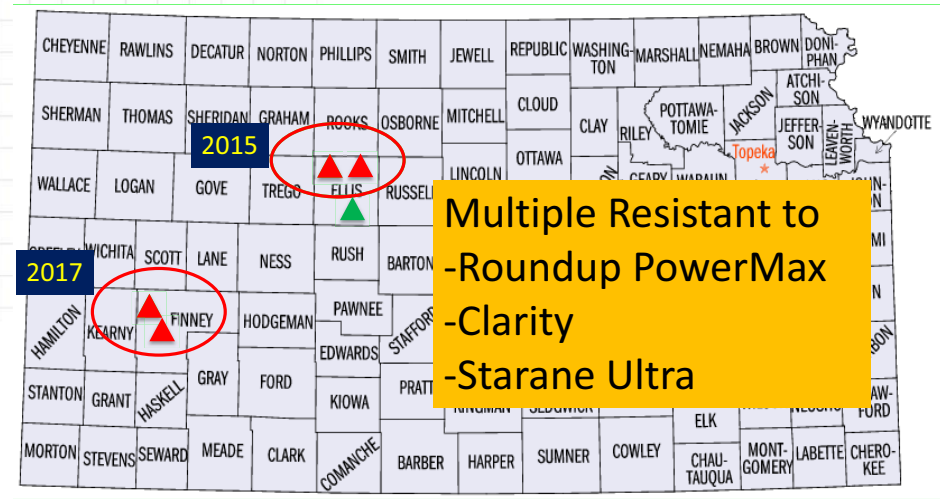
Herbicide	Total weed biomass (g m <sup>-2</sup> )	Grain yield (bu ac <sup>-1</sup> )
Roundup PowerMax (RuPM)	147 a	11 e
RuPM + Authority Supreme	98 b	14 cd
RuPM + Panther MTZ	91 b	12 de
RuPM + Fierce XLT	83 b	16 c
RuPM + Authority Supreme <i>fb</i> RuPM + Xtendimax	4 c	21 a
RuPM + Panther MTZ <i>fb</i> RuPM + Xtendimax	14 c	17 bc
RuPM + Fierce XLT <i>fb</i> RuPM + Xtendimax	2 c	20 ab

## Effect of Wheat Termination Timing on Total Weed Biomass and Soybean Yield at Hays

CC Termination	Total weed biomass (g m <sup>-2</sup> )	Grain yield (bu ac <sup>-1</sup> )
First termination	93 a	14 b
Second termination	54 b	17 a
Third termination	41 b	17 a

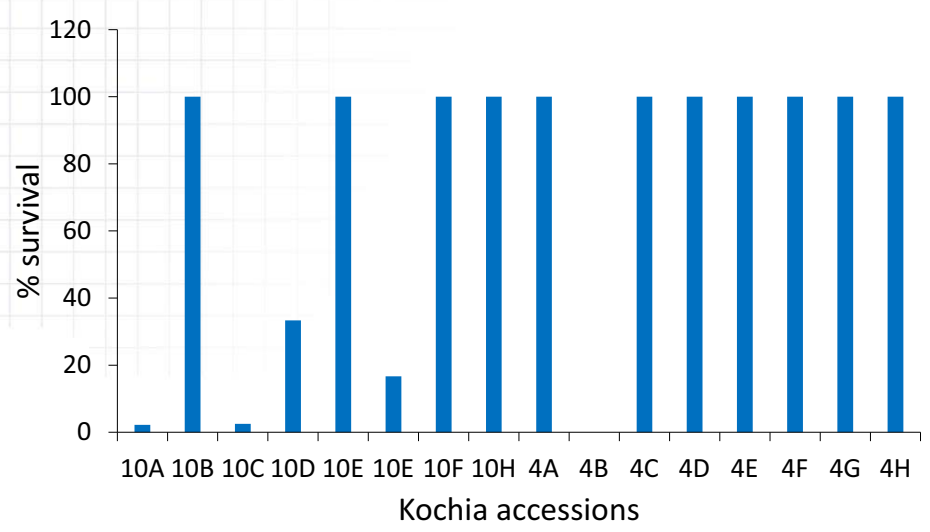


# Multiple Herbicide-Resistant Kochia in KS



Multiple Resistant to  
 -Roundup PowerMax  
 -Clarity  
 -Starane Ultra

## Response of Aux-Resistant Kochia to POST Atrazine



## Response to POST Atrazine (32 oz) at 21 DAT



## Response to PRE Atrazine (32 oz) at 30 DAT



Susceptible

Accession 4A

## Response to POST Sencor @ 12 oz/A



Accession 4 A

Accession 10 A

## Response to PRE Sencor (12 oz) at 30 DAT



Susceptible

Accession 4A

## Efficacy of Alternative POST Herbicides

Herbicide (s)*	Rate (fl oz/a)	% Injury	
		KS-SUS	4H
Huskie	15	96 a	98 a
Kochiavore	16	94 b	84 b
Scorch	32	83 c	79 bc
Starane NXT	14	85 c	87 b
Liberty	36	99 a	85 b
Tallinor	18	100 a	99 a
Sharpen	2	100 a	100 a
Sharpen + 2,4-D LV6	2 + 18	99 a	100 a
Gramoxone	48	100 a	100 a

\*Herbicides were applied with appropriate adjuvants as dictated by each label



# PRE Options and Timing for Kochia Control

Herbicide (s)*	Rate (oz/a)	Timing	5	13	17
			WASPRE	WASPRE	WASPRE
			% control		
Aatrex + Clarity	24 + 16	Fall	92	74	73
Aatrex + Clarity + Zidua	24 + 8 + 2.5	Fall	98	87	83
Aatrex + Clarity + Sharpen	24 + 8 + 2	Fall	96	70	65
Aatrex + Clarity + Corvus	24 + 8 + 3.3	Fall	98	85	79
Aatrex + Sharpen	24 + 2	Fall	94	68	65
Authority MTZ	12	Fall	96	79	76
Aatrex + Clarity	24 + 16	Spring	98	95	91
Aatrex + Clarity + Zidua	24 + 8 + 2.5	Spring	99	96	95
Aatrex + Clarity + Sharpen	24 + 8 + 2	Spring	99	95	93
Aatrex + Clarity + Corvus	24 + 8 + 3.3	Spring	98	95	91
Aatrex + Sharpen	24 + 2	Spring	96	86	81
Authority MTZ	12	Spring	94	87	85
LSD			2	6	7

<sup>1</sup> Fall treatments were applied on Dec 4, 2014 and Spring treatments were applied on Feb 23, 2015

<sup>2</sup> Abbreviation: WASPRE, weeks after spring-applied PRE herbicides

# Managing Feral rye in Winter Wheat



## Feral rye (*Secale cereale* L.)

- Problematic winter annual grass weed in wheat producing regions
- Germinates in fall or spring with soil temperatures 55 to 60 °F
- Contaminant in wheat grain: reduce milling, baking characteristics of wheat flour
- Cause winter wheat yield reduction up to 80%
- Single plant can produce up to 800 seeds that remain dormant and viable in soil for several yrs



## Feral rye Control in CoAXium™ Wheat at Great Bend

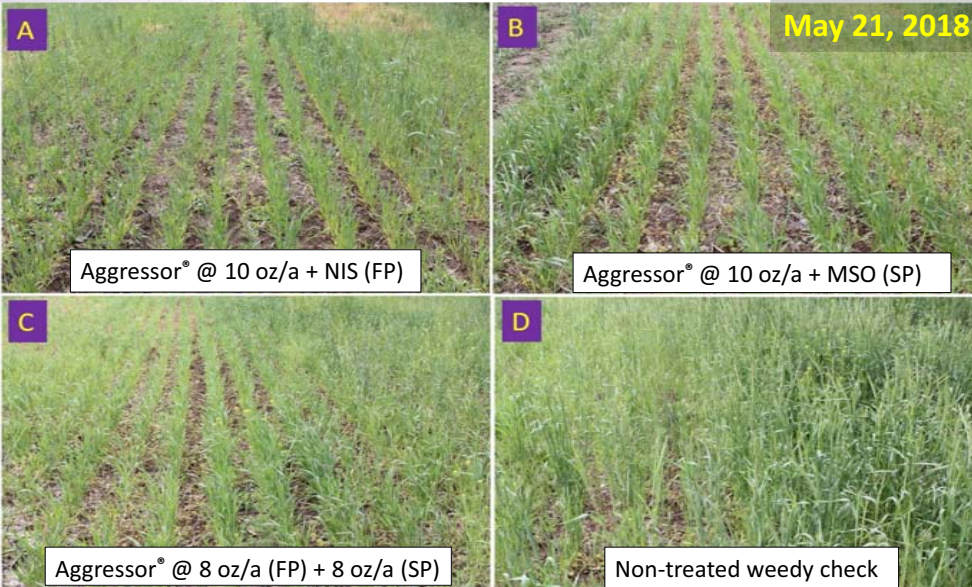
Herbicide	Rate (oz/a)	Timing <sup>c</sup>	Feral rye		
			4/18/19	5/2/19	6/6/19
			-----(% control)-----		
Aggressor + NIS <sup>a</sup>	10	FP	89 ab	94 ab	96 a
Aggressor + MSO <sup>b</sup>	10	FP	89 ab	94 ab	96 a
Aggressor + MSO <sup>b</sup>	10	SP	75 c	94 ab	96 a
Aggressor + MSO <sup>b</sup>	12	SP	80 bc	93 ab	94 a
Aggressor + NIS <sup>a</sup> / Aggressor + MSO <sup>b</sup>	8 (FP) + 8 (SP)	FP/SP	93 a	96 a	98 a

<sup>a</sup> Nonionic surfactant (NIS) at 0.25% v/v was included.

<sup>b</sup> Methylated seed oil (MSO) at 1% v/v was included.

<sup>c</sup> Fall Post (FP) was applied on Dec 19, 2018, Spring Post (SP) was applied on April 4, 2019.

## Feral rye Control in CoAXium™ Wheat



## Announcements



## Vipan Kumar

Research Weed Scientist  
KSU Ag Research Center  
1232 240<sup>th</sup> Avenue, Hays, KS  
Phone: 785-625-3425 ext. 214  
Email: [vkumar@ksu.edu](mailto:vkumar@ksu.edu)  
Twitter: @ARCHweedsience