

Managing Herbicide-Resistant Kochia and Palmer amaranth in Northwestern Kansas



Vipan Kumar, Ph.D.

Research Weed Scientist

Agricultural Research Center, Hays, KS

Palmer amaranth



When poll is active, respond at [PollEV.com/ksu](https://pollEV.com/ksu)
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Which of the following weed species is the most difficult to control in NW Kansas?

Kochia

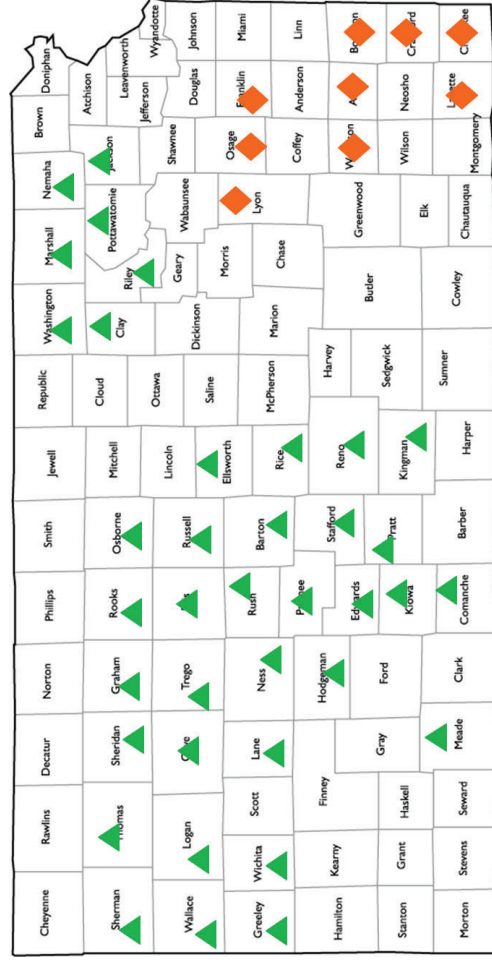
Palmer amaranth

Both

None of the above

Start the presentation to see live content. For screen share software, share the entire screen. Get help at pollEV.com/app

Statewide Herbicide-Resistant Pigweed Survey



Multiple Herbicide-Resistant Palmer amaranth

Barton County, KS:

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

Pratt County, KS:

- 2,4-D (2.0-fold)
- Roundup (8.6-fold)
- Glean (10.6-fold)
- AAtrex (3.7-fold)
- Callisto (2.8-fold)

Kiowa County, KS:

- 2,4-D (3.0-fold)
- Glean (2.3-fold)
- AAtrex (5.8-fold)
- Callisto (8.4-fold)



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



Palmer amaranth seedling surviving 18 fl oz/a rate of 2,4-D in greenhouse

Kumar et al. 2019; Pest Management Science: <https://doi.org/10.1002/ps.5400>
 Kumar et al. 2020; Agronomy Journal: <https://doi.org/10.1002/agj2.20173>

Herbicide Options for Palmer amaranth Control in Wheat Stubble

Herbicide Programs ^{a, b}	Rate (oz/a)	Herbicide groups	2019 % control at 4 WAT	2020 % control at 4 WAT
Nontreated	-	-	0	0
Roundup PowerMax	32	9	96	87
Clarity	16	4	82	76
2,4-D amine	32	4	87	79
Roundup PowerMax + Clarity	32+16	9 & 4	94	91
Roundup PowerMax + 2,4-D amine	32+32	9 & 4	98	95
Clarity + AAtrex	16+16	4 & 5	86	73
Clarity + 2,4-D amine	16+32	4	91	81
Gramoxone	48	22	99	98
Gramoxone + AAtrex	48+16	22 & 5	100	98
Gramoxone + Sencor	48+5	22 & 5	100	98
Gramoxone+Valor	48+2	22 & 14	100	97
Gramoxone + 2,4-D amine	48+32	22 & 4	100	98
Gramoxone + Spartan	48+4	22 & 14	100	98
Gramoxone + Authority Supreme	48+10	22 & 14, 15	100	98
Gramoxone + Panther MITZ	48+15	22 & 14, 15	99	94
Sharpen	2	14	93	89
Sharpen + AAtrex	2+16	14 & 5	93	79
Sharpen + Sencor	2+5	14 & 5	95	89
Sharpen + 2,4-D amine	2+32	14 & 4	97	88
Kochiavore	16	4	71	75
Huskie + AAtrex	15+16	6, 27 & 5	64	73
Liberty	36	10	92	89
Liberty + 2,4-D amine + Roundup PowerMax	36+32+32	10, 4, 9	98	97
Liberty + Clarity + Roundup PowerMax	36+16+32	10, 4, 9	97	96

^a Herbicide treatments were applied on 2 to 2.5 ft tall Palmer amaranth plants showing inflorescence initiation in postharvest wheat stubble
^b All treatments were applied with appropriate adjuvants as dictated by each herbicide label



Nontreated

Sept 14, 2020



Gramoxone + Spartan

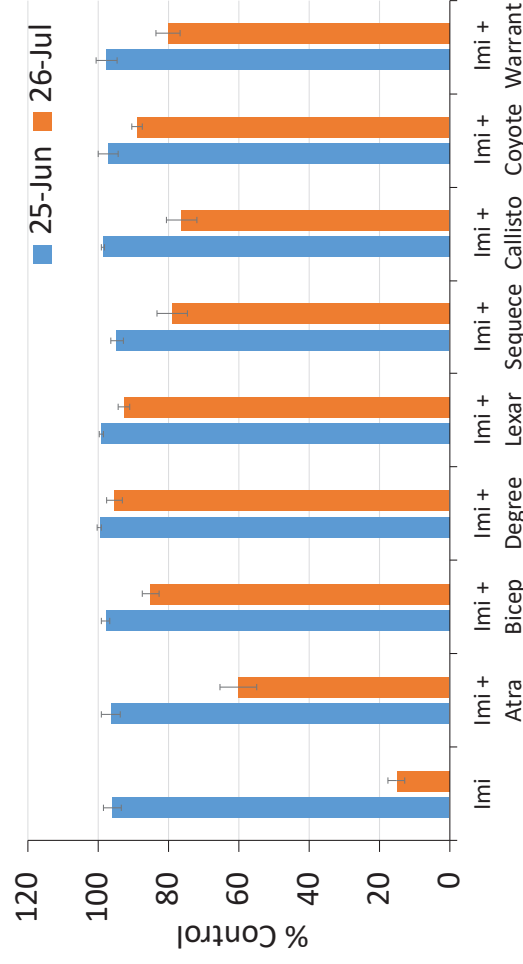
Imiflex with PRE Herbicides in Igrowth

Trt	Herbicide ¹	Rate, oz/A	Timing
1	Nontreated	-	-
2	Imiflex	9	PRE
3	Imiflex + Atrazine	9 + 48	PRE
4	Imiflex + Bicep II Magnum	9 + 57	PRE
5	Imiflex + Degree Xtra	9 + 80	PRE
6	Imiflex + Lexar EZ	9 + 96	PRE
7	Imiflex + Sequence	9 + 43	PRE
8	Imiflex + Callisto	9 + 6	PRE
9	Imiflex + Coyote	9 + 64	PRE
10	Imiflex + Warrant	9 + 64	PRE

¹All PRE herbicides were applied on June 10 at sorghum planting

Tank-Mixing Imiflex with PRE Herbicides for Palmer amaranth Control in Sorghum

Palmer amaranth Control in Igrowth Sorghum





July 26

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Imiflex at 9 oz/a



July 26

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Imiflex + Lexar EZ

Influence of Rainfall on the Timing and Efficacy of PRE/POST Soil Residual Herbicides for Control of Herbicide-Resistant Kochia and Palmer Amaranth

Kansas State University – Vipan Kumar & Jeanne Falk Jones
 University of Nebraska – Nevin Lawrence & Cody Creech
 Colorado State University – John Spring

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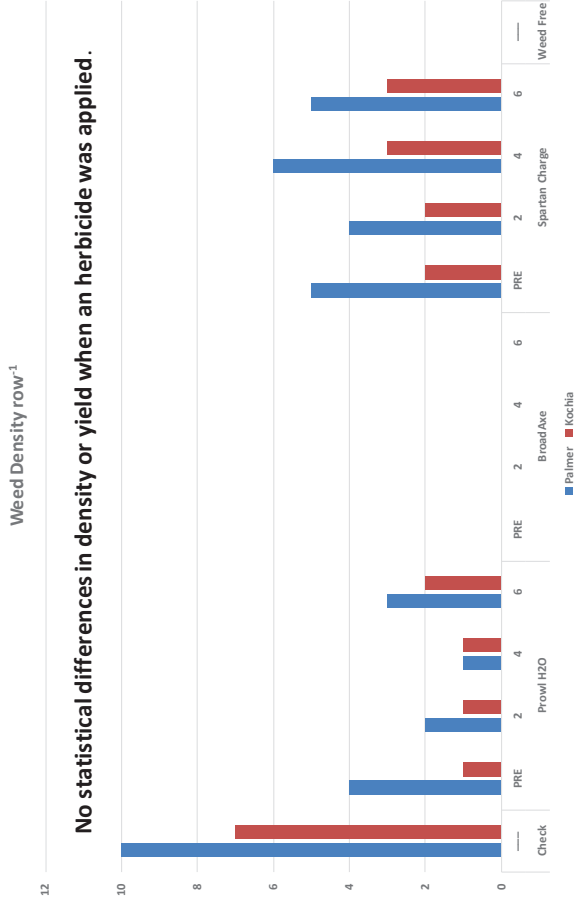
PRE/POST Zidua Herbicide Combinations

Treatment	Rate ¹	Application Timing
¹ Non treated check	—	—
Prowl H2O	2 pts	PRE
Prowl H2O fb* Zidua	2 pts fb 1.5 fl oz	PRE fb 2 TL
Prowl H2O fb Zidua	2 pts fb 1.5 fl oz	PRE fb 4 TL
Prowl H2O fb Zidua	2 pts fb 1.5 fl oz	PRE fb 6 TL
Broadaxe	2.1 fl oz	PRE
Broadaxe fb Zidua	2.1 fl oz fb 1.5 fl oz	PRE fb 2 TL
Broadaxe fb Zidua	2.1 fl oz fb 1.5 fl oz	PRE fb 4 TL
Broadaxe fb Zidua	2.1 fl oz fb 1.5 fl oz	PRE fb 6 TL
Spartan Charge	5 fl oz	PRE
Spartan Charge fb Zidua	5 fl oz fb 1.5 fl oz	PRE fb 2 TL
Spartan Charge fb Zidua	5 fl oz fb 1.5 fl oz	PRE fb 4 TL
Spartan Charge fb Zidua	5 fl oz fb 1.5 fl oz	PRE fb 6 TL
Hand weeded check	—	—

*Abbreviations: fb, followed by; PRE, pre-crop emergence
¹Product applied per acre.
²All treatments will include glyphosate as a PRE burndown.

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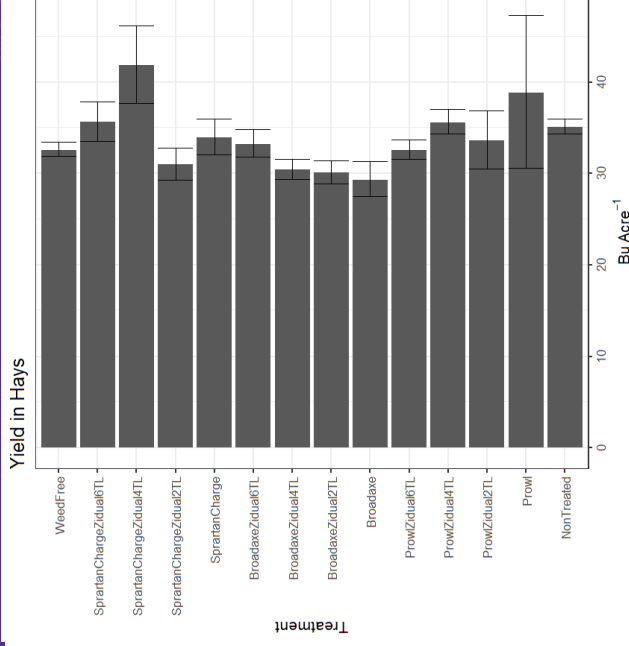
Zidua Herbicide Combinations – 2019 Hays



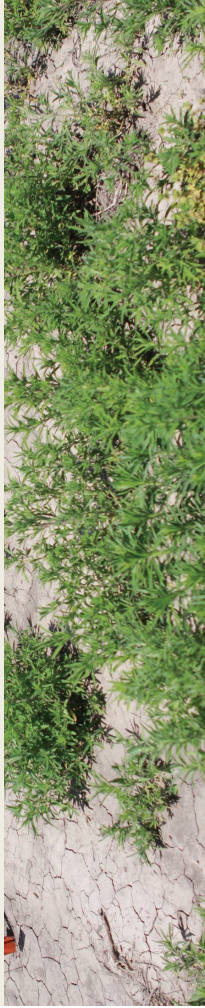
Zidua Herbicide Combinations – 2020 Hays

Kochia and Palmer control was improved with Broadaxe compared to Prowl.

No differences in biomass or yield.



MHR Kochia Control with Auxinic Mixtures



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To which of the following herbicides, kochia has developed resistance in Kansas?

- Glyphosate
- Dicamba
- Atrazine
- Fluroxypyr
- All of the Above
- None of the Above

Glyphosate-Resistant Kochia

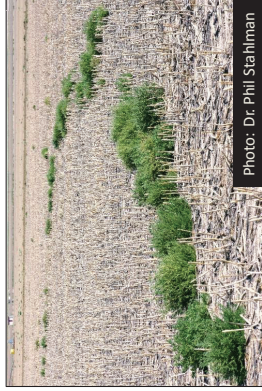
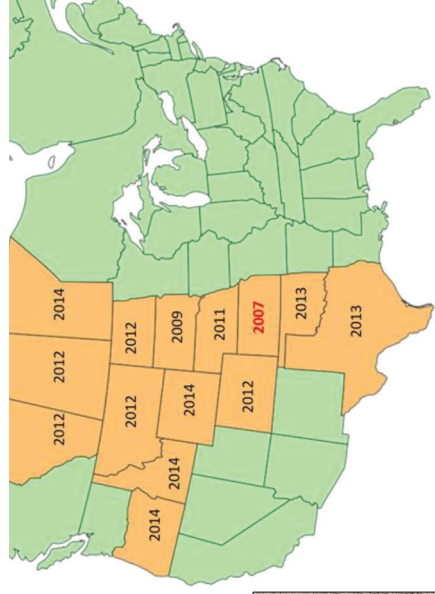


Photo: Dr. Phil Stahlman



Source: www.weedscience.com

PRE Options and Timing for Kochia Control

Herbicide (s)*	Rate (oz/a)	Timing	5 WASPRE	13 WASPRE	17 WASPRE
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

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¹ Fall treatments were applied on Dec 4, 2014 and Spring treatments were applied on Feb 23, 2015
² Abbreviation: WASPRE, weeks after spring-applied PRE herbicides

Dr. Currie and Thompson

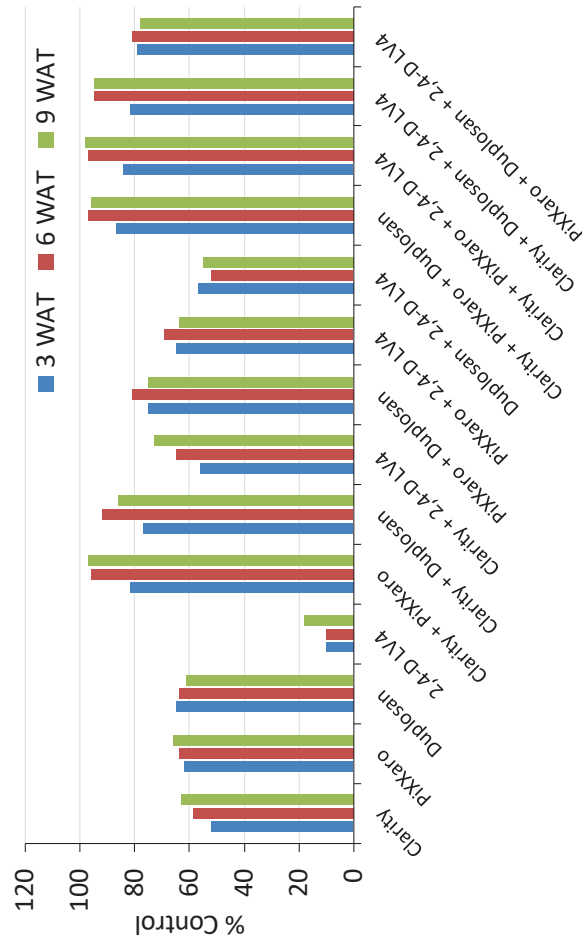
Auxinic Mixtures for Kochia Control

Trt	Herbicide ¹	Rate, oz/A	Timing
1	Clarity	16	POST
2	PIXXaro	6	POST
3	Duplosan	16	POST
4	2,4-D LV4	16	POST
5	Clarity + PIXXaro	16 + 6	POST
6	Clarity + Duplosan	16 + 16	POST
7	Clarity + 2,4-D LV4	16 + 16	POST
8	PIXXaro + Duplosan	6 + 16	POST
9	PIXXaro + 2,4-D LV4	6 + 16	POST
10	Duplosan + 2,4-D LV4	16 + 16	POST
11	Clarity + PIXXaro + Duplosan	16 + 6 + 16	POST
12	Clarity + PIXXaro + 2,4-D LV4	16 + 6 + 16	POST
13	Clarity + Duplosan + 2,4-D LV4	16 + 16 + 16	POST
14	PIXXaro + Duplosan + 2,4-D LV4	6 + 16 + 16	POST
15	Nontreated	-	-

¹ Treatments were applied at 3- to 4-in tall Kochia

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MHR Kochia Control with Auxinic Mixtures



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Nontreated Weedy Check



Duplosan at 16 oz/a



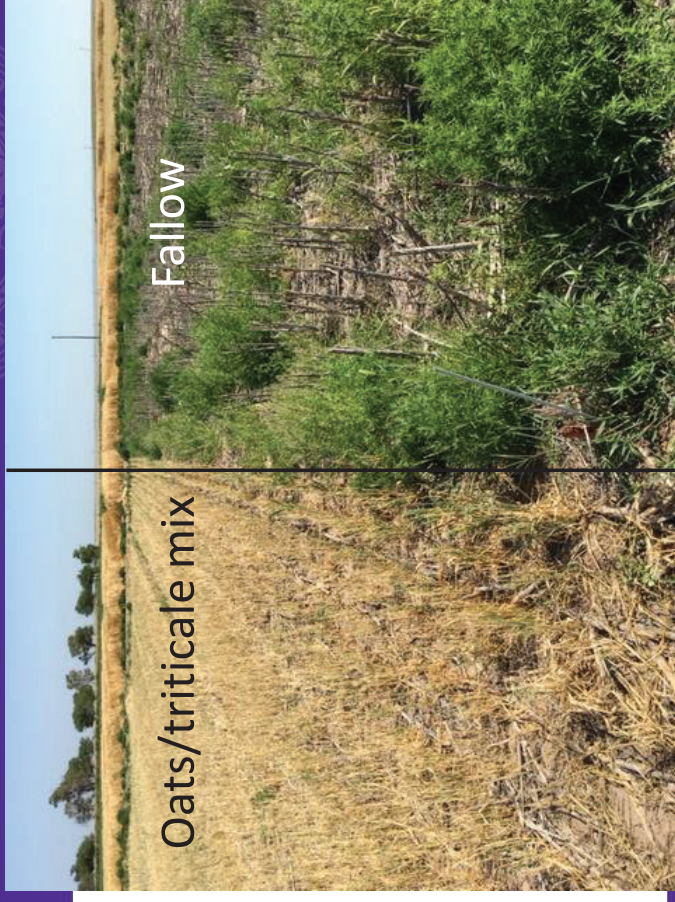
2,4-D LV 4 at 16 oz/a



Clarity at 16 oz/a + Duplosan at 16 oz/a + 2,4-D LV4 at 16 oz/a

Cover Crops in Dryland Kansas

Location	Cover crop treatment	Weed dry weight kg ha ⁻¹	Weed density plants m ⁻²
Colby	Fallow	2044 a	460 a
	Spring peas	180 b	64 b
	Oats/triticale	272 b	320 b
	Oats/triticale/pea	88 b	68 b
HB Ranch	Fallow	756 a	204 a
	Spring peas	16 b	40 b
	Oats/triticale	20 b	52 b
	Oats/triticale/pea	4 b	36 b



Questions?

Vipan Kumar

Research Weed Scientist
KSU Ag Research Center
1232 240th Avenue, Hays, KS
Phone: 785-625-3425 ext. 214
Email: vkumar@ksu.edu
Twitter: @ARCHweedsience