

Managing Herbicide-Resistant Kochia and Palmer amaranth in Northwestern Kansas



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Palmer amaranth



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Which of the following weed species is the most difficult to control in NW Kansas?

Kochia

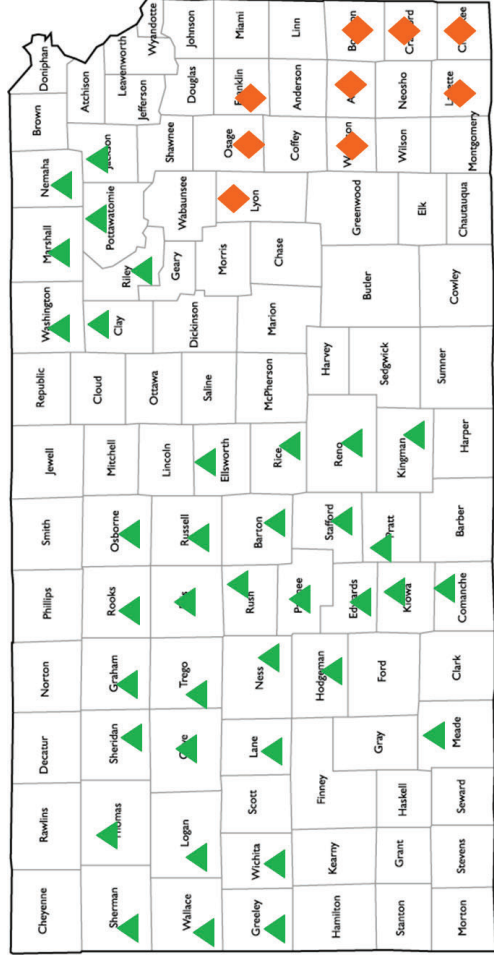
Palmer amaranth

Both

None of the above

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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



Nontreated

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

Sept 14, 2020



Gramoxone + Spartan

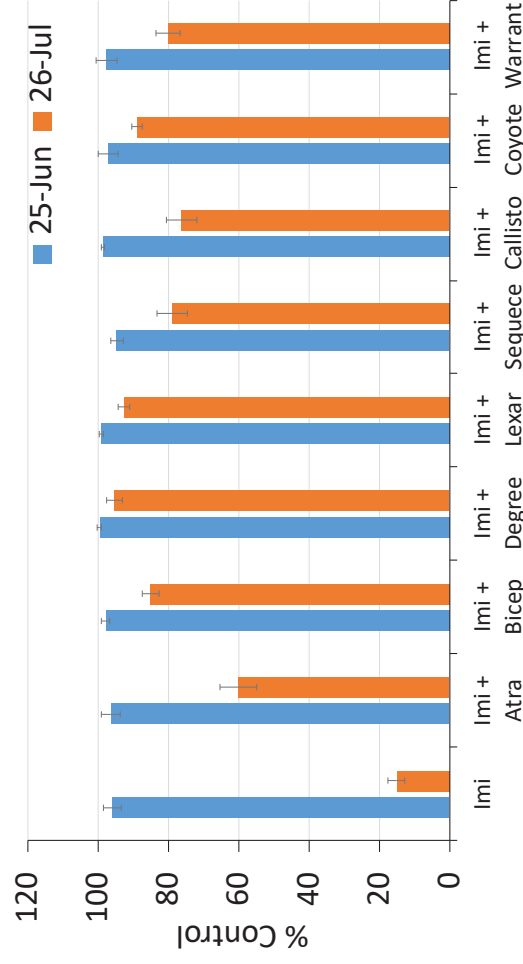
Imiflex with PRE Herbicides in Igrowth

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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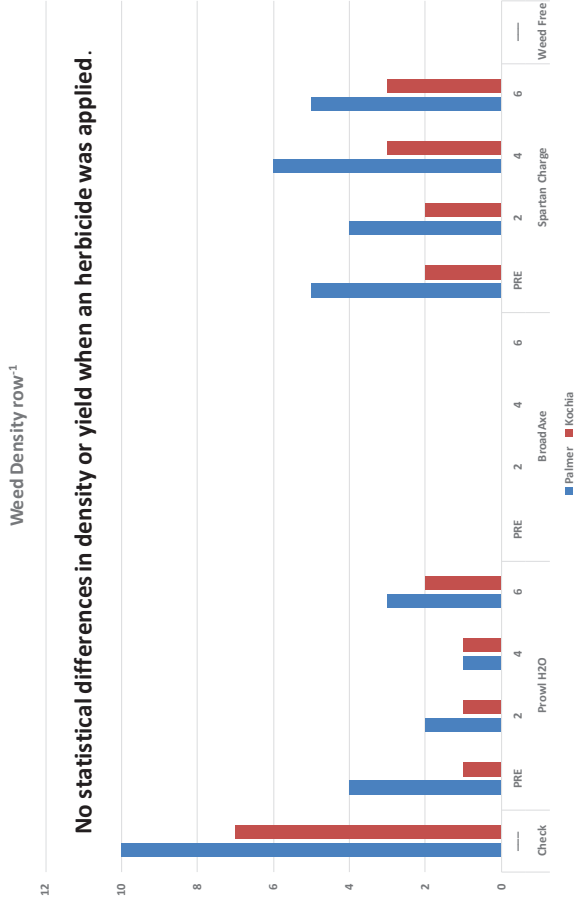
PRE/POST Zidua Herbicide Combinations

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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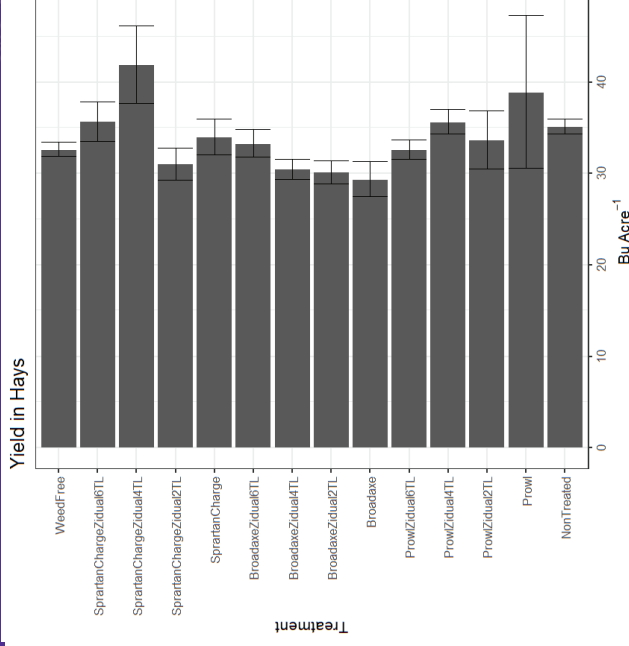
Zidua Herbicide Combinations – 2019 Hays



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

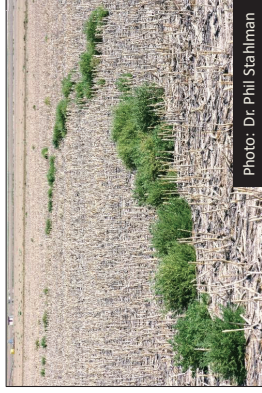


Photo: Dr. Phil Stahlman



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

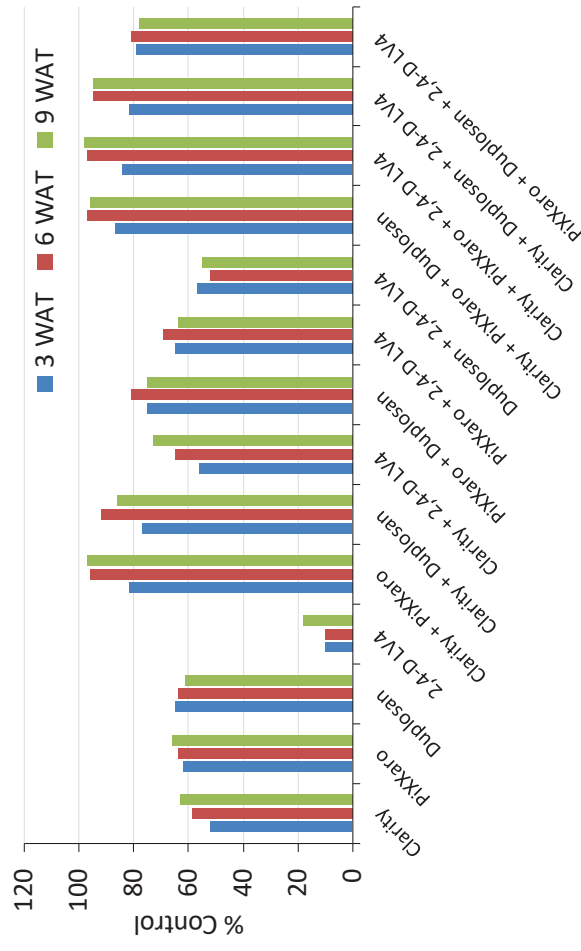
Auxinic Mixtures for Kochia Control

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



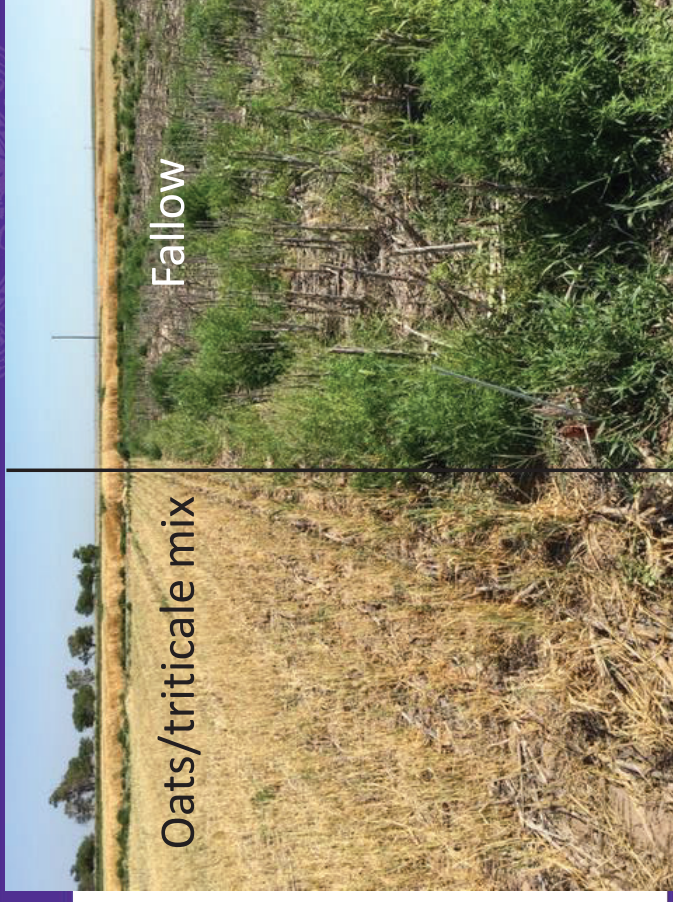
2,4-D LV 4 at 16 oz/a



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?

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