MANAGING TROUBLESOME WEEDS IN KANSAS

Sarah Lancaster
Assistant Professor and Extension Specialist – Weed Management
OUTLINE

1. EXTENSION WEED SCIENCE IS EXPANDING!
2. HERBICIDE UPDATE
3. RESISTANCE UPDATE
4. STRATEGIC TILLAGE
XTEND SYSTEM CHANGES

What we know:

- US District Court in AZ ruled the EPA violated FIFRA notice and comment mandates
  - Court did NOT find ESA violations

- The labels for XtendiMax, Engenia, and Tavium currently do not exist
  - EPA could choose to let ‘existing stocks’ be used

- Companies, commodity groups, and the EPA are working on a response/appeal to the court ruling
XTEND SYSTEM CHANGES

What can we do for weed control:

- Beef up residual programs
- Encourage canopy cover
- If XtendFlex – Liberty
  - Weed size and spray volume
  - Some evidence the Liberty + PPO inhibitor enhances pigweed control
- If Xtend (dicamba + glyphosate resistance only)
  - Reflex (if no PPO/Group 14 resistance)
  - Hooded sprayer???
ATRAZINE LABEL CHANGES

Section 24(c) – Special Local Needs labels not renewed
Wheat-Fallow rotations only labeled non-crop use

AATREX 4L ALONE – CHEMICAL FALLOW
Do not apply more than 2.25 lb ai/A for any application and do not apply more than one application per year. Users must only apply to fallow land in the following states according to the prescribed rotation pattern in the table below:

<table>
<thead>
<tr>
<th>Fallow Rotation Pattern</th>
<th>Fallow Use Authorized in these States only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat-Corn-Fallow</td>
<td>CO, KS, ND, NE, SD &amp; WY</td>
</tr>
<tr>
<td>Wheat-Fallow-Wheat</td>
<td>CO, KS, ND, NE, SD &amp; WY</td>
</tr>
<tr>
<td>Wheat-Sorghum-Fallow</td>
<td>AR, CO, GA, IL, KS, LA, MS, MO, NE, NM, NC, OK, SD &amp; TX</td>
</tr>
</tbody>
</table>
Storen
Syngenta
*Bicyclopyrone + mesotrione + pyroxasulfone + S-metolachlor*

Preplant (up to 28 days before planting) or preemergence
Postemergence (up to V8 corn or 3” weeds)
Split application
COC or MSO before corn emergence; NIS after corn emergence

All except Acuron applied with 0.75 lbs atrazine. No statistical differences among treatments ($\alpha = 0.05$)
Tarzec
Corteva
Pyroxsulam + halaxifen-methyl

Controls annual grasses (including cheatgrass and Italian ryegrass) and broadleaf weeds (including mustards)

Apply when wheat is 3 leaf to joint

Use 0.25% to 0.5% NIS or 1 to 1.25% COC when applied alone. See label instructions for tank mixing and applying in nitrogen fertilizer carrier.
Herbicide Resistance in Palmer Amaranth

<table>
<thead>
<tr>
<th>Herbicide group (example herbicide)</th>
<th>Number of cases</th>
<th>Year (and state) of first report</th>
<th>Year of first report in KS</th>
</tr>
</thead>
<tbody>
<tr>
<td>9, EPSPS inhibitor (glyphosate)</td>
<td>44</td>
<td>2005 (GA)</td>
<td>2011</td>
</tr>
<tr>
<td>2, ALS inhibitors (Beyond, Harmony, Glean, Pursuit)</td>
<td>25</td>
<td>1993 (KS)</td>
<td>1993</td>
</tr>
<tr>
<td>5, PSII inhibitors (atrazine, metribuzin)</td>
<td>11</td>
<td>1993 (TX)</td>
<td>1995</td>
</tr>
<tr>
<td>27, HPPD inhibitors (Callisto, Laudis, Impact)</td>
<td>7</td>
<td>2009 (KS)</td>
<td>2009</td>
</tr>
<tr>
<td>14, PPO inhibitors (Reflex, Cobra)</td>
<td>5</td>
<td>2011 (AR)</td>
<td>2021</td>
</tr>
<tr>
<td>4, Growth regulators (2,4-D, dicamba)</td>
<td>3</td>
<td>2015 (KS)</td>
<td>2015 (2,4-D)</td>
</tr>
<tr>
<td>2021 (dicamba)*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15, VLCFA inhibitors (Dual, Harness, Outlook, Zidua)</td>
<td>2</td>
<td>2016 (AR)</td>
<td>Not yet</td>
</tr>
<tr>
<td>10, Glutamine synthetase inhibitor (Liberty)</td>
<td>2</td>
<td>2020 (AR)</td>
<td>Not yet</td>
</tr>
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Weedscience.org
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<tr>
<td>9, EPSPS inhibitor (glyphosate)</td>
<td>27</td>
<td>2005 (MO)</td>
<td>2006</td>
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<tr>
<td>2, ALS inhibitors (Beyond, Harmony, Glean, Pursuit)</td>
<td>27</td>
<td>1993 (IL, IA)</td>
<td>1995</td>
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<tr>
<td>5, PSII inhibitors (atrazine, metribuzin)</td>
<td>15</td>
<td>1994 (MO)</td>
<td>1995</td>
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<tr>
<td>14, PPO inhibitors (Reflex, Cobra)</td>
<td>12</td>
<td>2001 (KS)</td>
<td>2001</td>
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<tr>
<td>27, HPPD inhibitors (Callisto, Laudis, Impact)</td>
<td>6</td>
<td>2009 (IL)</td>
<td>Not yet</td>
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<tr>
<td>4, Growth regulators (2,4-D, dicamba)</td>
<td>3</td>
<td>2009 (NE)</td>
<td>Not yet</td>
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<tr>
<td>15, VLCFA inhibitors (Dual, Harness, Outlook, Zidua)</td>
<td>1</td>
<td>2016 (IL)</td>
<td>Not yet</td>
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<tr>
<td>10, Glutamine synthetase inhibitor (Liberty)</td>
<td>1</td>
<td>2016 (IL)</td>
<td>??</td>
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</table>

Weedscience.org
# Herbicide Resistance in Kochia

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<th>Herbicide group (example herbicide)</th>
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<th>Year (and state) of first report</th>
<th>Year of first report in KS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2, ALS inhibitors (Glean)</td>
<td>20</td>
<td>1987 (KS)</td>
<td>1987</td>
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<tr>
<td>9, EPSPS inhibitor (glyphosate)</td>
<td>13</td>
<td>2007 (KS)</td>
<td>2007</td>
</tr>
<tr>
<td>5, PSII inhibitors (atrazine)</td>
<td>13</td>
<td>1976 (KS)</td>
<td>1976</td>
</tr>
<tr>
<td>4, Growth regulators (dicamba)</td>
<td>7</td>
<td>1994 (MT)</td>
<td>2013</td>
</tr>
<tr>
<td>14, PPO inhibitors (Valor, Sharpen, Authority)</td>
<td>2023 (ND)</td>
<td>Not yet</td>
<td></td>
</tr>
</tbody>
</table>

Weedscience.org
Survivors of 100x Saflufenacil

Mandan-R

Minot-R

Dr. Quincy Law
Soil-applied, not foliar

Dr. Brian Jenks
HERBICIDE MIXES DELAY TARGET-SITE RESISTANCE

Comont et al. 2020
BUT NOT METABOLIC RESISTANCE
HERBICIDES FOR PALMER AMARANTH CONTROL IN CORN

Preemergence to weeds

- **Group 5**
  - Atrazine
  - Princep
- **Group 14**
  - Valor
- **Group 15**
  - Isoxazoline
  - Zidua
  - Chloroacetamide
  - Dual
  - Harness
  - Outlook

Postemergence to weeds

- **Group 2**
  - SU
  - Accent
  - Beacon
  - Resolve
- **Group 9**
  - Glyphosate
- **Group 4**
  - Benzoate
  - Dicamba
  - Phenoxy
  - 2,4-D
- **Group 11**
  - Liberty
- **Group 14**
  - Triazolinone
  - Aim
  - Phenyl imide
  - Reviton
  - Sharpen
  - Valor
- **Group 27**
  - Triketone
  - Callisto,
  - Laudis
  - Pyrazole
  - Impact,
  - Shieldex
INTEGRATED MANAGEMENT

Mechanical control

Chemical control

Biological control

Cultural practices

IWM

Prevention
TUMBLE WINDMILLGRASS

Native, warm-season perennial
  – Regrowth from crowns and/or short rhizomes
    • Most root system 4 to 5 inches deep

Leaves flat, folded
  – Form a fan shape at the base
  – Leaf sheath has membranous margin

Panicles 10 to 16 branches in 2 to 4 whorls
  – Separate from stem at top node
1-2” SEEDLING CONTROL IN THE FIELD

Hennigh et al. 2005
CONTROL OF MATURE PLANTS MORE CHALLENGING

Hennigh et al. 2005
TURFGRASS STUDIES SUGGEST SEASON INFLUENCE

Junction City

Onaga

Percent TWG cover

4 WAT 52 WAT 8 WAT 52 WAT

Fall Summer Spring

Mitchell 2016
TILLAGE CAN SUPPRESS TUMBLE WINDMILLGRASS

Obour et al. 2021
METHODS

Established in conventionally-tilled sorghum residue

No-till
Sweep plow
– April 27
– Flex-King, 6’ blades
– 4-5” deep
METHODS

Sprayed June 3 (2 to 4” clumps)
- 15 GPA, TTJ 1102 tips
  • 64 oz Roundup PowerMax II
  • 32 oz SelectMax + 1% COC
  • 3 oz Callisto + 1% MSO
  • 2 oz Impact + 1% MSO
  • 28 oz Sinate + 1% MSO
  • 2 pts Remedy Ultra (applied with HPPD-inhibitors)

Rated July 8, August 8, September 12

Data analyzed for interactions of tillage and herbicides
CLETHODIM MOST CONSISTENT CONTROL

Percent TWG control

4 WAT 8 WAT 12 WAT

RUPM Callisto Impact Sinate SelectMax
TILLAGE INCREASED CONTROL

Percent TWG control

4 WAT 8 WAT 12 WAT

No-til Sweep plow
TILLAGE INCREASED CONTROL

No till Sweep plow

Percent TWG control

RUPM Callisto Impact Sinate SelectMax
OCCASIONAL TILLAGE STUDY

Treatments in W-S-F rotation

– No-till
– One tillage during summer prior to wheat drilling
– One tillage after wheat harvest (mid-August)
– Two tillage operations during the fallow phase
– One tillage during fallow phase and one tillage post wheat harvest

2 locations – Tribune and Garden City

Holman et al, 2023
This is sorghum, after the wheat crop in the W-S-F rotation

Table 1. Grain yield response of dryland wheat to a single tillage operation (sweep plow) in a 3-year wheat-sorghum-fallow rotation grown from 2014 to 2022 near Tribune, KS

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Tillage</td>
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</tr>
<tr>
<td>No-tillage</td>
<td>28</td>
<td>24</td>
<td>75</td>
<td>30</td>
<td>57</td>
<td>93</td>
<td>45</td>
<td>69</td>
<td>14</td>
<td>48a</td>
</tr>
<tr>
<td>June in fallow</td>
<td>22</td>
<td>22</td>
<td>81</td>
<td>25</td>
<td>58</td>
<td>89</td>
<td>40</td>
<td>65</td>
<td>13</td>
<td>46b</td>
</tr>
<tr>
<td>July post-harvest</td>
<td>23</td>
<td>21</td>
<td>77</td>
<td>27</td>
<td>57</td>
<td>89</td>
<td>42</td>
<td>67</td>
<td>13</td>
<td>46b</td>
</tr>
</tbody>
</table>

ANOVA (P > F)

| Treatment | 0.427 | 0.599 | 0.174 | 0.477 | 0.857 | 0.202 | 0.130 | 0.365 | 0.628 | 0.034   |

ANOVA = analysis of variance.

Table 2. Grain yield response of dryland grain sorghum to a single tillage operation (sweep plow) in a 3-year wheat-sorghum-fallow rotation grown from 2014 to 2022 near Tribune, KS

<table>
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<tbody>
<tr>
<td>Tillage</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No-tillage</td>
<td>77</td>
<td>133</td>
<td>129</td>
<td>147</td>
<td>130</td>
<td>132</td>
<td>99</td>
<td>121</td>
<td>75a</td>
<td>116a</td>
</tr>
<tr>
<td>June in fallow</td>
<td>84</td>
<td>114</td>
<td>129</td>
<td>145</td>
<td>123</td>
<td>129</td>
<td>102</td>
<td>110</td>
<td>66b</td>
<td>111b</td>
</tr>
<tr>
<td>July post-harvest</td>
<td>86</td>
<td>108</td>
<td>126</td>
<td>141</td>
<td>115</td>
<td>131</td>
<td>94</td>
<td>115</td>
<td>61b</td>
<td>109b</td>
</tr>
</tbody>
</table>

ANOVA (P > F)

| Treatment | 0.573 | 0.104 | 0.280 | 0.567 | 0.065 | 0.779 | 0.259 | 0.002 | 0.012 | 0.004   |

ANOVA = analysis of variance.
This is sorghum, after the wheat crop in the W-S-F rotation

<table>
<thead>
<tr>
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<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>No-tillage</td>
<td>93.4</td>
<td>45.1</td>
<td>68.8</td>
<td>14.1</td>
<td>55.4</td>
</tr>
<tr>
<td>In fallow 1×</td>
<td>89.3</td>
<td>40.1</td>
<td>64.5</td>
<td>12.6</td>
<td>51.6</td>
</tr>
<tr>
<td>In fallow 2×</td>
<td>88.2</td>
<td>40.3</td>
<td>71.4</td>
<td>11.2</td>
<td>52.8</td>
</tr>
<tr>
<td>Post-wheat 1×</td>
<td>88.9</td>
<td>42.3</td>
<td>66.6</td>
<td>13.2</td>
<td>52.8</td>
</tr>
<tr>
<td>In fallow and post-wheat 1×</td>
<td>92.4</td>
<td>40.7</td>
<td>69.5</td>
<td>11.1</td>
<td>53.4</td>
</tr>
</tbody>
</table>

ANOVA (P > F) Treatment: 0.4455 0.1304 0.3286 0.2704 0.0881

Tillage after wheat harvest reduced sorghum yields

<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>No-tillage</td>
<td>132.0</td>
<td>98.9</td>
<td>120.5</td>
<td>75.0</td>
<td>106.6</td>
</tr>
<tr>
<td>In fallow 1×</td>
<td>128.7</td>
<td>102.2</td>
<td>109.8</td>
<td>66.0</td>
<td>101.7</td>
</tr>
<tr>
<td>In fallow 2×</td>
<td>133.3</td>
<td>95.5</td>
<td>119.9</td>
<td>73.9</td>
<td>105.7</td>
</tr>
<tr>
<td>Post-wheat 1×</td>
<td>130.7</td>
<td>94.0</td>
<td>115.3</td>
<td>60.9</td>
<td>100.2</td>
</tr>
<tr>
<td>In fallow and post-wheat 2×</td>
<td>132.0</td>
<td>86.3</td>
<td>115.8</td>
<td>64.0</td>
<td>99.5</td>
</tr>
</tbody>
</table>

ANOVA (P > F) Treatment: 0.8653 0.2590 0.1998 0.7034 0.1986

ANOVA = analysis of variance.

Holman et al, 2023
TAKE HOME MESSAGE

FEW NEW PRODUCTS, LOTS OF NEW REGULATIONS

BE PROACTIVE ABOUT HERBICIDE RESISTANCE MANAGEMENT ON YOUR FARM

STRATEGIC TILLAGE MAY BE A VIABLE OPTION FOR YOUR OPERATION