LAYERED RESIDUAL HERBICIDES
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Dicamba update - traits

• XtendFlex
• Resistant to
  • Dicamba
  • Glyphosate
  • Glufosinate
Herbicide registrations

**Corn**
- Impact Core
  - Impact + acetochlor
  - 20-40 fl oz/A through 11”
  - AMS plus MSO
- Sinate
  - Impact + Liberty
  - 21-28 fl oz/A through V7/24”
  - AMS plus MSO or HSOC

**Soybean**
- Kyber
  - Same products as Fierce MTZ (pyroxasulfone + flumioxazin + metribuzin)
- Panther MTZ
  - Same products as Dimetric Charged (metribuzin + flumioxazin)
Other label updates

- Anthem Flex – sunflowers and soybean added to label
- Anthem Maxx – apply through V6 soybean (was V3)
- Authority Edge – soybean and sunflower added to label
- BroadAxe – rotation restriction for dry beans added (4 months)
- Outlook – increase to 31 fl oz/A/yr (was 21 fl oz/A/yr)
- Zidua – apply through V8 corn (anticipated)

Atrazine registration review

- Interim decision released Sept 2020
- Two more assessments
  - Endangered species assessment (deadline 9/28/21)
  - Endocrine disruptor screening
- Changes most likely to affect Kansas farmers
  - 15 MPH weed speed restriction
  - 5-foot buffer from edge of streams/rivers and endangered species habitat
  - Medium-sized droplets or larger
What are the two most challenging weeds in your crops?

**Corn herbicide application calendar**

- **Oct - Dec:** Fall
  - Control emerged winter annuals
- **March:** EPP
  - If no fall applications
- **April:** PRE
  - Spend your money HERE
- **May:** EPOST
  - Plan to apply 21-28 days after PRE
- **June:** LPOST
  - Scout fields to determine need
Residual herbicide activity

Herbicide persistence

- The length of time a herbicide is active in soil
- Needs to be in a ‘sweet spot’ for residual herbicides
  - Want extended control
  - Don’t want carryover

Adapted from Hartzler and Anderson 2019
Herbicide persistence

- Described by the half-life (t1/2)
- Time required for one-half of the herbicide to dissipate

![Graph showing percent herbicide remaining over time](image)

Half-life of some residual herbicides

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Example</th>
<th>SOA group</th>
<th>Half-life</th>
<th>Control duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pendimethalin</td>
<td>Prowl H2O</td>
<td>3</td>
<td>44 d</td>
<td></td>
</tr>
<tr>
<td>Atrazine</td>
<td>Aatrex 4L</td>
<td>5</td>
<td>60 d</td>
<td></td>
</tr>
<tr>
<td>Acetochlor</td>
<td>Harness</td>
<td>15</td>
<td>4-20 d*</td>
<td>8-12 weeks</td>
</tr>
<tr>
<td>S-metolachlor</td>
<td>Dual II Magnum</td>
<td>15</td>
<td>30-50 d</td>
<td>10-14 weeks</td>
</tr>
<tr>
<td>Dimethenamid-P</td>
<td>Outlook</td>
<td>15</td>
<td>20 d</td>
<td></td>
</tr>
<tr>
<td>Pyroxasulfone</td>
<td>Zidua</td>
<td>15</td>
<td>16-26 d</td>
<td></td>
</tr>
<tr>
<td>Flumioxazin</td>
<td>Valor</td>
<td>14</td>
<td>12-18 d</td>
<td></td>
</tr>
<tr>
<td>Saflufenacil</td>
<td>Sharpen</td>
<td>14</td>
<td>1-36 d</td>
<td></td>
</tr>
<tr>
<td>Isoxaflutole</td>
<td>Balance Flexx</td>
<td>27</td>
<td>0.5-2.4 d</td>
<td></td>
</tr>
</tbody>
</table>

*Ma et al, 2004

Herbicide Handbook, 2014
Microbial degradation

• Influenced by:
  • Sorption
  • Previous applications

Microbial degradation

• Influenced by:
  • Moisture
Microbial degradation

- Influenced by:
  - Soil temperature

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Residual herbicide activity

Adapted from Hartzler and Anderson 2019
Weed escapes still produce seed

Up to 7 MILLION seeds per acre

Residual herbicide activity

Adapted from Hartzler and Anderson 2019
Which herbicides have you used as a layered residual?
## Herbicides to consider as layered residuals

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Example</th>
<th>SOA group</th>
<th>Activation</th>
<th>Crop</th>
<th>Restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrazine</td>
<td>Aatrex 4L</td>
<td>5</td>
<td>NA</td>
<td>Corn</td>
<td>12”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grain sorghum</td>
<td>2-5 lf</td>
</tr>
<tr>
<td>Acetochlor</td>
<td>Harness</td>
<td>15</td>
<td>1/4-3/4”</td>
<td>Corn</td>
<td>11”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grain sorghum</td>
<td>11”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Soybean</td>
<td>R2</td>
</tr>
<tr>
<td>S-metolachlor</td>
<td>Dual II Magnum</td>
<td>15</td>
<td>1/2-1”</td>
<td>Corn</td>
<td>12”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grain sorghum</td>
<td>12”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Soybean</td>
<td>75 d PHI</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V3</td>
<td></td>
</tr>
<tr>
<td>Dimethenamid-P</td>
<td>Outlook</td>
<td>15</td>
<td>NA</td>
<td>Corn</td>
<td>12”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grain sorghum</td>
<td>12”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Soybean</td>
<td>V5</td>
</tr>
<tr>
<td>Pyroxasulfone</td>
<td>Zidua</td>
<td>15</td>
<td>1/2”</td>
<td>Corn</td>
<td>V4”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Soybean</td>
<td>V6</td>
</tr>
<tr>
<td>Mesotrione</td>
<td>Callisto</td>
<td>27</td>
<td>1/4”</td>
<td>Corn</td>
<td>V8</td>
</tr>
</tbody>
</table>

*Warrant = 30”
**V8 anticipated

### Weed control 60 DAP

Warrant (2.5 qts/A)

![Graph showing weed control at 60 DAP](image)

- waterhemp
- velvetleaf
- grn foxtail

Jhala et al. 2015
Common waterhemp control
4, 8, & 16 WAP

Is 95% control enough?
Palmer amaranth example

Seed rain year 1

350,000 \text{ seeds/acre} \times 20\% = 70,000 \text{ viable seeds/acre}

Plants emerged year 2

70,000 \text{ seeds} \times 40\% = 28,000 \text{ plants/acre}

Plants escaped year 2

28,000 \text{ plants} \times 95\% = 1,400 \text{ plants/acre}

Resistant plants year 2

1,400 \text{ plants} \times 84\% = 1,176 \text{ plants/acre}

Seed rain from resistant plants year 2

1,176 \text{ plants} \times 487 \text{ seeds/plant} = 572,712 \text{ seeds/acre}
## Is 95% control enough? Marestail example

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seed rain year 1</strong></td>
<td>74,800 seeds acre × 30% = 22,500 viable seeds acre</td>
</tr>
<tr>
<td><strong>Plants emerged year 2</strong></td>
<td>22,500 seeds × 80% = 18,000 plants acre</td>
</tr>
<tr>
<td><strong>Plants escaped year 2</strong></td>
<td>18,000 plants × 95% = 900 plants acre</td>
</tr>
<tr>
<td><strong>Resistant plants year 2</strong></td>
<td>900 plants × 50% = 450 plants acre</td>
</tr>
<tr>
<td><strong>Seed rain from resistant plants year 2</strong></td>
<td>450 plants × 900 seeds plant = 405,000 seeds acre</td>
</tr>
</tbody>
</table>

## Marestail control in Enlist soybean

![Graph showing control or injury (%) for different treatments.](image)

- **Enlist + RUPM fb Enlist + RUPM**
- **Enlist + RUPM + Fierce**
- **Enlist + RUPM + Authority MTZ fb Enlist + RUPM + Anthem Maxx**
- **Enlist + RUPM + Fierce EZ fb Enlist + RUPM + Perpetuo**

- 5 WAP
2021 Chemical Weed Control
for Field Crops, Pastures, Rangeland, and Noncropland

WAR
AGAINST
WEEDS

SILVER BULLETS ARE FOR WEREWOLVES