COVERS CROPS AS AN INTEGRATED MANAGEMENT STRATEGY AGAINST TROUBLEsome WEEDS IN KANSAS

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Herbicide resistance in troublesome weeds

<table>
<thead>
<tr>
<th></th>
<th>Palmer amaranth</th>
<th>Waterhemp</th>
<th>Kochia</th>
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<tbody>
<tr>
<td><strong>ALS inhibitors</strong></td>
<td></td>
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<tr>
<td>Group 2 (Classic, Harmony, Pursuit)</td>
<td>X</td>
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<td><strong>Plant growth regulators</strong></td>
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<td>Group 4 (2,4-D, dicamba, Starane Ultra)</td>
<td>X</td>
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<td><strong>PSII inhibitors</strong></td>
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<td>Group 5 (atrazine)</td>
<td>X</td>
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<td><strong>EPSPS inhibitor</strong></td>
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<td>Group 9 (glyphosate)</td>
<td>X</td>
<td>X</td>
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<td><strong>Glutamine synthetase inhibitor</strong></td>
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<td>Group 10 (glufosinate)</td>
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<td><strong>PPO inhibitors</strong></td>
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<td>Group 14 (Cobra, Reflex)</td>
<td>&lt;, S</td>
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<td>X</td>
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<td><strong>HPPD inhibitors</strong></td>
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<td>Group 27 (Armezon, Callisto, Laudis)</td>
<td>X</td>
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<td><strong>Multiple resistance</strong></td>
<td>3- &amp; 5-way</td>
<td>2-way</td>
<td>2- &amp; 4-way</td>
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</tbody>
</table>

K. Heap, 2021; < = reduced sensitivity; x = suspected
Best management practices for herbicide resistance

- Competitive crop
- Cover crops
- Tillage
- Seed bank management
- Scouting

How cover crops suppress weeds

- Alter moisture, temperature during weed seed germination
- Outcompete emerging weeds for light, water, and nutrients
- Release allelochemicals that inhibit weed seed germination
How cover crops suppress weeds

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BIOMASS PRODUCTION

Relationship between fall-sown cover crop biomass and weed suppression

Meta-analysis

Lower response ratio indicates greater weed suppression

18 studies

Osipitan et al., 2019

16 studies

"Weed biomass
R = 0.78e^{-0.008(CC biomass)}
\text{r}^2 = 0.67"

"Weed density
R = 0.81e^{-0.02(CC biomass)}
\text{r}^2 = 0.64"
Added cover crop species do NOT increase biomass production

22 studies from 23 years

Pounds cover crop biomass acre⁻¹

Monoculture  Biculture  Polyculture

Monoculture  Biculture  Polyculture

Fall cover crop suppression of kochia
2007 & 2008, Garden City KS

R² = 0.87
f=0.01*exp(1496.36/(x+222.92))

NO relationship with spring-planted covers
Integrated pigweed management in Kansas

- 2 crops, 2 years, 3 locations
- Cover crop, row-width, cultivation, herbicides

Herbicide program provided > 97% weed control
- Row width reduced pigweed growth in some environments
- Cover crop generally suppressed pigweeds

Hay et al., 2019
Pigweed density 8 WAP soybean

No herbicide, no tillage

Manhattan
Palmer amaranth
2 years
P<0.01

Ottawa
Waterhemp
2 years
P<0.05

Pigweed density 8 WAP grain sorghum

No herbicide, no tillage

1.0"–2.6" rain 2 WAP
Palmer amaranth
3 site-years
P<0.0001

0.3" rain 2 WAP
Palmer amaranth
Hutchinson, 2018
P<0.01

4.2" rain 2 WAP
Waterhemp
Ottawa, 2017
NS

0.7" rain 2 WAP
Waterhemp
Ottawa, 2018
NS
**Pigweed height 8 WAP**

No herbicide, no tillage

- Manhattan
  - Palmer amaranth
  - Soybean
  - 2 years
  - P < 0.1

- Hutchinson
  - Palmer amaranth
  - Soybean
  - 2018 (dry)
  - NS

- Hutchinson
  - Palmer amaranth
  - Grain sorghum
  - 2018 (dry)
  - P < 0.05

- Ottawa
  - Waterhemp
  - Grain sorghum
  - 2017 (wet)
  - P < 0.0001

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**Cover crop biomass slows Palmer amaranth growth**

Cover crops associated with 3-13 day delay in Palmer amaranth reaching 4 inches

- Hay et al., 2019
- Wiggins et al., 2017
Cover crop management for weed suppression

- Species selection
  - Proportion of cereals or other ‘aggressive’ species in mix is key for weed suppression

- Planting date
  - Sufficient cover crop biomass before key weeds emerge

- Termination
  - Closer to production crop planting increases weed suppression
  - Method less important