A Review of the Effects of Various Cover Crop Species on Winter and Summer Annual Weed Emergence

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My Perspective

Based on our research and the results of other published studies, the ability of cover crops to reduce the emergence of WINTER ANNUAL weed species:

- Is usually good but rarely 100%
- Is dependent on the winter annual weed species and time of weed emergence
- Is dependent on the cover crop species and/or mix selected
Cover Crops are a Great Fit for Winter Annual Weeds!
Successful Establishment of Cover Crops = Reduction in Winter annual Weed Emergence

Winter Annual Weed Emergence Sequence in Nebraska as Influenced by Thermal Time Accumulation

Influence of Cover Crops vs. Herbicide Treatments on Cumulative Winter Annual Weed Density
(results summarized across 9 site-years in Missouri)

Non-treated Control
Fall Herbicide Only
Austrian Pea
Hairy Vetch
Crimson Clover
Tillage Radish
Oats
Italian Ryegrass
Cereal Rye/Hairy Vetch
Cereal Rye
Wheat

*Bars followed by the same letter are not different, LSD 0.05

Influence of Vetch and Cereal Rye Cover Crops on Winter Annual Weed Density in Maryland

<table>
<thead>
<tr>
<th>Cover Crop Species</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-treated Control</td>
<td>431 a</td>
<td>1,120 a</td>
</tr>
<tr>
<td>Vetch</td>
<td>108 b</td>
<td>500 b</td>
</tr>
<tr>
<td>Cereal Rye/Vetch Mix</td>
<td>123 b</td>
<td>323 b</td>
</tr>
<tr>
<td>Cereal Rye</td>
<td>48 b</td>
<td>364 b</td>
</tr>
</tbody>
</table>

*Means followed by the same letter are not different.


<table>
<thead>
<tr>
<th>Location</th>
<th>Field</th>
<th>Percentage of ground covered by weeds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Late fall</td>
<td>Forage radish</td>
</tr>
<tr>
<td>BARC-NF</td>
<td>A</td>
<td>0b</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0b</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>0b</td>
</tr>
<tr>
<td>BARC-SF</td>
<td>D</td>
<td>0c</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>0c</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>0b</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>0b</td>
</tr>
<tr>
<td>CMREC</td>
<td>I</td>
<td>0b</td>
</tr>
<tr>
<td>WREC</td>
<td>J</td>
<td>0b</td>
</tr>
<tr>
<td></td>
<td>Late March</td>
<td>Forage radish</td>
</tr>
<tr>
<td>BARC-NF</td>
<td>A</td>
<td>0b</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>1b</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>0b</td>
</tr>
<tr>
<td>BARC-SF</td>
<td>D</td>
<td>0c</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>3b</td>
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<tr>
<td></td>
<td>F</td>
<td>1b</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>1b</td>
</tr>
<tr>
<td>CMREC</td>
<td>I</td>
<td>0b</td>
</tr>
<tr>
<td>WREC</td>
<td>J</td>
<td>2b</td>
</tr>
</tbody>
</table>

Successful cover crop establishment will prevent the emergence of horseweed (a.k.a. marestail), one of the most widespread glyphosate-resistant weeds in the U.S.

Horseweed Life Cycle

- Fall emergence biotype
- Spring emergence biotype
- Winter survival
- Spring germination
- Bolting
- Flowering
- Fall germination
- Winter survival
- Senescence and seed dispersal

Nandula 2006
Integration of a Cereal Rye Cover Crop for the Control of Glyphosate-resistant Horseweed/Marestail

% Horseweed Control at Planting

<table>
<thead>
<tr>
<th></th>
<th>No Cover Crop</th>
<th>Cereal Rye Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
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<tr>
<td>50</td>
<td></td>
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<tr>
<td>75</td>
<td></td>
<td></td>
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<tr>
<td>100</td>
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</tbody>
</table>

My Perspective

Based on our research and the results of other published studies, the ability of cover crops to reduce the emergence of **SUMMER ANNUAL** weed species is determined by the:

1. Cover crop species selected
2. Amount of cover crop biomass accumulated
3. Time of cover crop termination/rate of cover crop decay
4. Type of weed species
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All cover crops should not be viewed equally...

• Consider how easy or difficult it might be to terminate the cover crop you select.

• Consider the “weediness” potential of the cover crop you select.
All cover crops should not be viewed equally...

Consider what kind of summer annual weed control you can get out of cover crops that will winter kill.

Influence of Cover Crops vs. Herbicide Treatments on Early Season Waterhemp Emergence
(results summarized across 9 site-years in Missouri)

*Bars followed by the same letter are not different, LSD_{0.05}*

Influence of Cover Crops vs. Herbicide Treatments on Late Season Waterhemp Emergence
(results summarized across 9 site-years in Missouri)

*Bars followed by the same letter are not different, LSD_{0.05}*


Influence of Cover Crops on Palmer Amaranth Emergence in Georgia

Influence of Cover Crops on Palmer Amaranth Control Prior to Corn Planting

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Relationship Between Rolled Cover Crop Biomass and Pigweed Control After Planting

![Graph showing the relationship between cover crop biomass and Palmer Amaranth control.](image1)

Influence of Cereal Rye Seeding Rate on Weed Biomass 10 Weeks after Cereal Rye Termination

![Bar chart showing the effect of seeding rate on weed biomass.](image2)


Which situation will provide more opportunity for summer annual weed emergence?

![No Cover Crop](image1.png)  ![Cereal Rye](image2.png)

Glyphosate + 2,4-D applied 14 days previous

**Relationship Between Rye Residue Levels and the Amount of Sunlight Reaching the Soil Surface**

![Graph](image3.png)

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The rate of cover crop decomposition will be directly related to the weed control you get...

![Graph showing the remaining biomass in 2009/10 and 2010/11 seasons for different crops: Oat, Rye, Ryegrass.](image-url)

The rate of cover crop decomposition will be directly related to the weed control you get...

**Relationship Between Inhibitory Potential of Cover Crops and Various Weed Species**

- Winter cover crop
- Winter annual weed 1
- Winter annual weed 2
- Summer annual weed 1

What could get you this far?
- Cover crops w/ allelopathic properties
- Cover crops w/ high biomass and/or slower rates of decomposition
- Residual herbicides

Adapted from Kruidhof et al. 2010. Weed Research 51:177-186.
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Different Weed Seeds are Affected Differently by: soil cover, light, temperature, soil depth, etc.

- We have seen greater success of cover crops on small-seeded broadleaf weeds and grasses
- Much less on larger-seeded broadleaf weeds like cocklebur and giant ragweed
Website: weedscience.missouri.edu

App: ID Weeds (free download)

Facebook: Mizzou Weed Science

Twitter: @ShowMeWeeds