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

Cumulative Emergence (%) vs. Thermal Time (T_{base} = 0 C)

- Carolina foxtail
- Downy brome
- Shepherd's-purse
- Pinnate tansymustard
- Henbit
- Virginia pepperweed
- Dandelion
- Field pennycress
- Purslane speedwell
- Field pansy
- Fall
- Winter
- Spring

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

*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

**Hayden et al. 2012. Weed Technology 26:818-825.**

<table>
<thead>
<tr>
<th>Cover Crop Species</th>
<th>2010</th>
<th>2011</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Plants / m²</td>
<td>Plants / m²</td>
</tr>
<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>
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<tr>
<td>Cereal Rye/Vetch Mix</td>
<td>123 b</td>
<td>323 b</td>
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<tr>
<td>Cereal Rye</td>
<td>48 b</td>
<td>364 b</td>
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*Means followed by the same letter are not different.*
Influence of a Radish and Cereal Rye Cover Crop on Weed Groundcover across 9 Sites in Maryland

<table>
<thead>
<tr>
<th>Location</th>
<th>Field</th>
<th>Forage radish</th>
<th>No cover crop</th>
<th>Rye</th>
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<tr>
<td></td>
<td></td>
<td>Late fall %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BARC-NF</td>
<td>A</td>
<td>0b</td>
<td>40a</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0b</td>
<td>83a</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>0b</td>
<td>24a</td>
<td>–</td>
</tr>
<tr>
<td>BARC-SF</td>
<td>D</td>
<td>0c</td>
<td>78a</td>
<td>–</td>
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<tr>
<td></td>
<td>E</td>
<td>0c</td>
<td>94a</td>
<td>10b</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>0b</td>
<td>96a</td>
<td>0b</td>
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<tr>
<td></td>
<td>G</td>
<td>0b</td>
<td>94a</td>
<td>0b</td>
</tr>
<tr>
<td>CMREC</td>
<td>I</td>
<td>0b</td>
<td>8a</td>
<td>0b</td>
</tr>
<tr>
<td>WREC</td>
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<td>0b</td>
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<td></td>
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<td>Late March %</td>
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<td>BARC-NF</td>
<td>A</td>
<td>0b</td>
<td>84a</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>1b</td>
<td>39a</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>0b</td>
<td>71a</td>
<td>–</td>
</tr>
<tr>
<td>BARC-SF</td>
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<td>0c</td>
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<td>7b</td>
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<td></td>
<td>F</td>
<td>3b</td>
<td>99a</td>
<td>1b</td>
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<td>G</td>
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<td>H</td>
<td>22b</td>
<td>53a</td>
<td>4c</td>
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<tr>
<td></td>
<td>I</td>
<td>0b</td>
<td>22a</td>
<td>0b</td>
</tr>
<tr>
<td>WREC</td>
<td>J</td>
<td>2b</td>
<td>55a</td>
<td>0b</td>
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</table>

<table>
<thead>
<tr>
<th>Location</th>
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<th>Typical time of corn planting</th>
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<td>BARC-NF</td>
<td>A</td>
<td>37c</td>
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<tr>
<td></td>
<td>B</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>C</td>
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<tr>
<td>BARC-SF</td>
<td>E</td>
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<tr>
<td></td>
<td>F</td>
<td>37ab</td>
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<tr>
<td></td>
<td>G</td>
<td>11</td>
</tr>
<tr>
<td>CMREC</td>
<td>H</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>4†</td>
</tr>
</tbody>
</table>

† Weeds sprayed with herbicides before typical time of corn planting.

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
- Senescence and seed dispersal
- Fall germination
- Winter survival

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

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

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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 **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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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:

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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)

- Non-treated Control
- Non-residual Burndown
- Fall Herbicide Only
- Full Residual Program
- 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 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}*

Waterhemp Emergence (#/m²)

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

Influence of Cover Crops on Palmer Amaranth Emergence in Georgia

Palmer Amaranth Density (#/m2)

Early Season

Late Season

- No Cover Crop
- Cereal Rye
- Cereal Rye + Vetch
- Cereal Rye + Crimson Clover
- Cereal Rye + Winter Pea

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

Palmer Amaranth Control (%)

- No Cover Crop
- Hairy Vetch
- Crimson Clover

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Relationship Between Rolled Cover Crop Biomass and Pigweed Control After Planting

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

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

Glyphosate + 2,4-D applied 14 days previous

No Cover Crop

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

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