Cover Crop Termination
Methods and Challenges

Daniel H. Smith, Elizabeth J. Bosak, Vince M. Davis
Cover crops are of increasing interest to producers in the upper Midwest region due to many agronomic benefits.

Cover crops have been utilized for many years in organic production.

While cover crops are of increasing interest there may be challenges to termination.

Over winter potential?
Cover Crop or Forage Crop?

- Cover crops are no longer cover crops if harvested as a forage and fed to livestock. This would be classified as a forage crop and has different herbicide restrictions.
- Example: winter rye (cereal rye) is established in the fall and harvested in the spring for forage.
Potential Benefits of Cover Crops

- Reducing soil erosion
- Providing and scavenging nutrients
- Weed suppression
- Improved soil health
- Reducing soil moisture losses
- Protecting water quality
- Reducing production costs
- Increased yield
In Fall 2013 the North Central Sustainable Agriculture Research and Education (SARE) program with the Conservation Technology Information Center (CTIC) conducted a survey of cover crop use. The majority of farmers were from the Mississippi river basin. The farmers were asked to project their 2014 use.

**Cover Crop Acres**
The SARE/CITC survey asked farmers what cover crops they were currently utilizing.

**Cover Crop Use in the Midwest**

<table>
<thead>
<tr>
<th>Cover Crop</th>
<th>Percent Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter Cereal Grains</td>
<td>65%</td>
</tr>
<tr>
<td>Annual Grasses</td>
<td>55%</td>
</tr>
<tr>
<td>Legumes</td>
<td>45%</td>
</tr>
<tr>
<td>Brassicas</td>
<td>60%</td>
</tr>
<tr>
<td>Multi-Species Mix (3 or more)</td>
<td>35%</td>
</tr>
<tr>
<td>Summer Annual Broadleaf</td>
<td>20%</td>
</tr>
<tr>
<td>Other</td>
<td>5%</td>
</tr>
</tbody>
</table>
The SARE/CITC survey asked farmers what their biggest challenges with cover crops have been. >15% of respondents indicated cover crop becomes a weed!

Challenges:
- Increased disease potential
- Yield reduction in the following crop
- Nitrogen immobilization
- Increases overall crop production risk
- Increased insect potential
- Other
- Cover crop becomes a weed in the following year
- Cover crop sometimes uses too much soil moisture
- No measurable economic return
- Cover crop seed availability
- Cost of planting and managing cover crops
- Selecting the right cover crop for my operation
- Cover crop seed cost
- Establishing cover crops
- Time/labor required for planting and management

Biggest Cover Crop Challenges (Percent of Respondents) N=1415
The SARE/CITC survey asked farmers their primary cover crop termination method. >48% of respondents utilize herbicides!
Cover Crops = Spring Weeds?

Not if planned for and managed correctly!
Italian Ryegrass, better known as **annual ryegrass**, shows resistance to 5 herbicide site of action groups in Arkansas, California, Mississippi, North Carolina, Oregon, and Tennessee. States where much of the annual ryegrass cover crop seed is produced
• Certain cover crops can over winter from seeds. Examples: rye, buckwheat, and hairy vetch
• **Seed Production**: many cover crops can quickly flower and produce seed in the spring
Overwinter-Yes
Overwinter-No
Overwinter-Maybe

Annual Ryegrass
Variety dependent
2013 3 out of 4 varieties
Survived
Termination Challenges

Difficult to Terminate: annual ryegrass, hairy vetch, clovers, and rye
<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Winterkill</th>
<th>Crimping</th>
<th>Mowing</th>
<th>Tillage</th>
<th>Herbicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brassica</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canola/Radish</td>
<td>Maybe</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Glyphosate</td>
</tr>
<tr>
<td>Red Clover</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>?</td>
<td>Glyphosate + Dicamba or 2,4-D</td>
</tr>
<tr>
<td>Crimson Clover</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes*</td>
<td>Glyphosate + Dicamba or 2,4-D</td>
</tr>
<tr>
<td>Berseem Clover</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes*</td>
<td>Glyphosate + Dicamba or 2,4-D</td>
</tr>
<tr>
<td>Winter pea</td>
<td>Maybe</td>
<td>No</td>
<td>Yes</td>
<td>Yes*</td>
<td>Glyphosate + Dicamba or 2,4-D</td>
</tr>
<tr>
<td>Sweet Clover</td>
<td>Maybe</td>
<td>No</td>
<td>No</td>
<td>?</td>
<td>Glyphosate + Dicamba or 2,4-D</td>
</tr>
<tr>
<td>Hairy Vetch</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes*</td>
<td>Glyphosate + Dicamba or 2,4-D</td>
</tr>
<tr>
<td>Annual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual</td>
<td>Maybe</td>
<td>No</td>
<td>No</td>
<td>Yes*</td>
<td>Glyphosate-See later results</td>
</tr>
<tr>
<td>ryegrass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter barley</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
<td>Glyphosate 4.5 lb ae per gal, 22 fl oz per acre</td>
</tr>
<tr>
<td>Winter wheat</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
<td>Glyphosate 4.5 lb ae per gal, 22 fl oz per acre</td>
</tr>
<tr>
<td>Winter rye</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes*</td>
<td>Glyphosate 4.5 lb ae per gal, 22 fl oz per acre</td>
</tr>
</tbody>
</table>

Tillage Note- May require multiple passes and tillage should fully incorporate cover crop to prevent regrowth. Chart Adopted from WCWS 204 Cover Crop Termination by Elizabeth Bosak and Vince Davis
Weather

- Termination should occur during a period of active growth
- Day/night temperatures should be 55/40°F and should be above these temperatures for 3 days pre and post application
- Application should occur four hours prior to sunset
Field Trials

• Trial #1 Glyphosate termination of winter rye and annual ryegrass heights exceeding current recommendations

• Trial #2 Winter rye and annual ryegrass termination utilizing mowing, mowing + collection, and mowing + collection + glyphosate

• Neither trial examined herbicide combinations that may antagonize control
Comparison of glyphosate application rates for winter rye and annual ryegrass with heights exceeding current recommendations

Hypothesis: Termination will be most effective when the ryegrass and winter rye are actively growing early in the spring
• Control annual ryegrass prior to 6 inches of growth. Control winter rye prior to boot stage or ≤18 inches of growth

Crop Heights 5-23-14
Annual Ryegrass 6-18”
Winter Rye-34-40”
NRCS Recommendations

- Terminate cover crops at or within 5 days after planting, but before crop emerge (NRCS Cover Crop Termination Guidelines December 2013)
Purdue Recommendations

- Annual ryegrass - Ideally terminate when plant is less than 6 inches in height, prior to jointing, and use translocated herbicides.
- Good terminated achieved using glyphosate, fomesafen+glyphosate (Flexstar GT©), paraquat + atrazine
- Winter Rye - 22 fl oz glyphosate up to 18 inches in height (Successful Cover Crop Termination with Herbicides Purdue Ext. Fall 2013)
• Winter Rye - 18 fl oz glyphosate up to 16 inches in height
(Integrated Crop Management News Spring 2014)
Materials and Methods

- Annual ryegrass and winter rye plots were established in the fall of 2013 following silage harvest. Varieties utilized include three varieties of annual ryegrasses ‘Bruiser,’ ‘Gulf,’ and ‘King’ and ‘Guardian’ winter rye.
- RCB with 4 Replications and each trial included a nontreated control
### Planting Depth and Seeding Rate of Cover Crops

<table>
<thead>
<tr>
<th></th>
<th>Winter rye</th>
<th>Annual ryegrasses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depth (in)</strong></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Seeding Rate (lb ac⁻¹)</strong></td>
<td>120</td>
<td>32</td>
</tr>
</tbody>
</table>
**Trial Methods**

- Glyphosate applied on May 23rd, May 29th, and June 4th.
- Glyphosate rates include 0, 16, 32, 64, and 128 ounces per acre.
- Roundup PowerMAX© 4.5 lb ae/gal applied with 17 lbs/100 gallon AMS.
Trial Methods

- Application were sprayed at 15 GPA using XR11002 flat fan nozzles pressurized at 18 psi
- Boom height 20 inches above canopy
- Ideal Weather Conditions!
Materials and Methods

- Two weeks after application, the cover crops were evaluated for herbicide injury. The data were collected with digital imagery analysis for percent cover and for total dried biomass collected from a 0.25m$^2$ quadrat per subplot.

- Digital images were taken at 91 cm above each cover crop in every plot. The camera (Canon PowerShot A1400) was mounted at a 70 degree angle on a 2.5 cm by 114 cm board, set to auto mode with zoom set to 0. This board created a stand for the camera to capture consistent photos of all subplots.
Percent Cover Calculation Procedure

SigmaScan Pro 5® and Turf Analysis 1-2 Macro

Percent cover is estimated using the software to turn the green pixels red and then they are counted.
‘King’ annual ryegrass nontreated vs treated

- May
- Mid-May
- Early-June
• Percent green cover of annual ryegrass (AR) and winter rye (WR) decreased (P<0.0001) for all cover crops at all rates at 14 days after application.

• AR and WR dry biomass weight was significantly decreased (P<0.001) at the 16 fl. Oz. rate for early May and June.
2014 Results

May Percent Green Cover 14 DAT

Cover crops with heights (cm) at application

Percent

Nontreated
Early May

'Gulf' 15-30
'Bruiser' 20-30
'King' 20-25
winter rye 76-81
Late-May Percent Green Cover 14 DAT

Cover crops with heights (cm) at application

'Gulf' 30-36
'Brusier' 20-30
'King' 25-36
Winter rye 91-117
2014 Results

Early-June Percent Cover 14 DAT

Cover crops with heights (cm) at application

- 'Gulf' 50-63
- 'Bruiser' 50-61
- 'King' 46-56
- Winter rye 127-151
Conclusions

• Our preliminary results indicate that winter rye and annual ryegrass can be effectively terminated using a glyphosate rate of 16 fl. oz. if targeted under good weather conditions. Repeat trial in 2015.
• All three annual ryegrasses had similar growth and good winter survival in 2014.
Conclusions

• More termination research is needed to establish best management practices based on rates, crop heights and to better define where glyphosate performance may be reduced due to weather conditions.
Trial #2

- Objective- Determine if termination of winter rye and annual ryegrass are significantly affected using methods of termination that include mowing, mowing plus collection of biomass, herbicide application, mowing plus herbicide application, and mowing plus collection and herbicide application.
Materials and Methods

• RCB Design with 4 Replications
• Establishment and data collection procedures same and trial #1
Treatments

- Two Timings - Mid May (5/23/14) and full anthesis of winter rye (6/5/14)
- Glyphosate (4.5 lb ae 32 fl. oz/acre)
- Glyphosate + Mowing + Collection
- Mowing + Collection
Full Anthesis

- Recommended stage for crimping
- 2014 - June 6th
Mid-May 2014 Results
Two weeks after mowing - no glyphosate
Mid-May 2014 Results

Two Weeks after mowing - no glyphosate
2014 Results

Percent Green Cover Mid-May Timing
14 DTA

- Winter Rye
- Annual Ryegrass

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Percent Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nontreated</td>
<td>90</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>80</td>
</tr>
<tr>
<td>Mowing</td>
<td>30</td>
</tr>
<tr>
<td>Mowing + Glyphosate</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>
One week after glyphosate application-32 fl. oz/ac 4.5 ae/gal
2014 Results

Percent Green Cover Full Anthesis Timing 14 DTA

- Winter Rye
- Annual Ryegrass

Treatment:
- Nontreated
- Glyphosate
- Mowing
- Mowing + Glyphosate
Conclusions

- Percent green cover of annual ryegrass and winter rye was decreased (P<0.0001) for all treatments
- Mowing + Collection was only effective at slowing down the growth of both annual ryegrass and winter rye.
- Both species grew back quickly, especially annual ryegrass after mowing
- Glyphosate was effective both alone and with mowing + collection
Wisconsin Crop Weed Science Website:
http://wcws.cals.wisc.edu/
**Cover Crop Termination**

Elizabeth Bosak and Vince Davis  
Department of Agronomy, University of Wisconsin-Madison

This quick sheet is intended to give a brief overview of cover crop termination methods and suggestions for termination using herbicides. These recommendations are specifically for cover crops - NOT forage crops that will be fed to animals.

The chart to the right includes all of the cover crops listed by the Midwest Cover Crops Council broken into three categories: Brassica, Legume, and Non-legume. The seeding dates listed are based on the Midwest Cover Crops Council suggested last seeding date for good cover crop establishment prior to the first hard frost. Last seeding dates vary according county in Wisconsin and the chart contains dates for Columbia county.

If there is a "X" for a specific cover crop, then it should likely winterkill and no spring termination is required. If there is an "*", then depending on either the variety or severity of the winter it may not winterkill. This chart does not consider changes in winter hardiness due to mixing cover crop species such as hairy vetch with oats.

For some of these cover crop species, like hairy vetch, hard seed will continue to germinate throughout the season and the following growing seasons. Remember to check your seed container for the percentage of hard seed. The initial cover crop may winterkill, but more seedlings emerging in subsequent crops may become weeds.

On the reverse side of this sheet, there is a chart of termination methods and herbicides for termination of legumes and winter cereals that will survive a Wisconsin winter. Please remember to factor in the site-of-action(s) of your cover crop burndown application into your herbicide resistance management plan.

Termination methods include mowing, rolling/crimping, tillage, and chemical desiccation with herbicides. Final choice of a termination method may depend on your goal for that cover crop. For instance, if you planted buckwheat to attract pollinators, but do not want a buckwheat weed problem, then you should mow the buckwheat before seeds start to develop.

**Cover Crop Termination (WCWS 204)**

**WCWS Fact Sheet 204**

Available as free download on WCWS webpage  
Authors: Liz Bosak and Vince Davis
### Cover Crop Termination (WCWS 204)

<table>
<thead>
<tr>
<th>Cover Crop Type</th>
<th>Winterkill</th>
<th>Rolling Crimping</th>
<th>Moving</th>
<th>Tillage</th>
<th>Herbicide</th>
<th>Cover Crop Growth Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canola/Rapeseed</td>
<td>* NO NO YES</td>
<td>YES</td>
<td></td>
<td></td>
<td>Glyphosate, may require multiple applications (see reference 3)</td>
<td></td>
</tr>
<tr>
<td>Red Clover</td>
<td>NO NO NO YES</td>
<td></td>
<td></td>
<td></td>
<td>Glyphosate + Dicamba or 2,4-D</td>
<td></td>
</tr>
<tr>
<td>Sweet Clover</td>
<td>NO NO NO YES</td>
<td></td>
<td></td>
<td></td>
<td>Glyphosate or 2,4-D (see reference 3)</td>
<td></td>
</tr>
<tr>
<td>Winter Pea</td>
<td>YES NO YES</td>
<td></td>
<td></td>
<td></td>
<td>Glyphosate + 2,4-D or either product alone</td>
<td></td>
</tr>
<tr>
<td>Hairy Vetch</td>
<td>NO YES NO</td>
<td></td>
<td></td>
<td></td>
<td>Glyphosate + Dicamba or 2,4-D</td>
<td></td>
</tr>
<tr>
<td>Annual Ryegrass</td>
<td>NO NO NO YES</td>
<td></td>
<td></td>
<td></td>
<td>Glyphosate 4.5 lb ae per gal, 22 fl oz per acre</td>
<td></td>
</tr>
<tr>
<td>Winter Barley</td>
<td>NO YES NO YES</td>
<td></td>
<td></td>
<td></td>
<td>SEE BELOW</td>
<td></td>
</tr>
<tr>
<td>Winter Triticale</td>
<td>NO YES NO YES</td>
<td></td>
<td></td>
<td></td>
<td>SEE BELOW</td>
<td></td>
</tr>
<tr>
<td>Winter Wheat</td>
<td>NO YES NO YES</td>
<td></td>
<td></td>
<td></td>
<td>SEE BELOW</td>
<td></td>
</tr>
<tr>
<td>Winter/Cereal Rye</td>
<td>NO YES NO YES</td>
<td></td>
<td></td>
<td></td>
<td>SEE BELOW</td>
<td></td>
</tr>
</tbody>
</table>

* May not winterkill depending on variety and/or severity of the winter
  * Difficult to terminate using tillage alone

Annual ryegrass termination recommendation: Plan for two applications of glyphosate at the FULL labeled rate and a tank mix of other herbicides to provide additional sites of action and residual weed control. Be sure that any herbicides added to glyphosate do not antagonize ryegrass control. Only apply herbicide during active growth with day/night temperatures above 55/40 F for at least 3 consecutive days. Application should occur at least four hours prior to sunset. Please be aware that annual ryegrass, *Lolium perenne ssp. multiforum*, has shown resistance to 5 herbicide sites-of-action according to the International Survey of Herbicide Resistant Weeds (Heap, 2014). Also, populations resistant to one or multiple sites-of-action have been identified in 14 other states. Glyphosate-resistant populations have been found in Arkansas, California, Mississippi, North Carolina, Oregon, and Tennessee.

**Always follow the product’s current label restrictions and instructions.**

### References:


**Additional resources:**

Pesticide labels and material safety data sheets (MSDS) can be viewed at [http://www.cdms.net/LabelsMeds/LMDefault.aspx](http://www.cdms.net/LabelsMeds/LMDefault.aspx)

Midwest Cover Crops Council [http://www.mccc.msu.edu/](http://www.mccc.msu.edu/)

TakeAction Herbicide Classification chart [http://wcws.cals.wisc.edu/documents](http://wcws.cals.wisc.edu/documents)

Take Action on Weeds website, sponsored by the United Soybean Board, [http://takeactiononweeds.com](http://takeactiononweeds.com)
Midwest Cover Crops Council Cover Crop Decision Tools

The Midwest Cover Crop Council (MCCC) Cover Crop Decision Tools are web-based systems to assist farmers in selecting cover crops to include in field crop and vegetable rotations.

Instructions for Using the Cover Crop Decision Tool - Field Crops

Go to the Cover Crop Decision Tool - Field Crops
(If your browser is Internet Explorer (IE), please close the Favorites Pane for proper display)

http://www.mccc.msu.edu/selectorINTRO.html
## Midwest Cover Crop Selection Tool

### Wisconsin: Columbia County Seeding Dates

<table>
<thead>
<tr>
<th>Location Information</th>
<th>Cash Crop Information</th>
<th>Soil Information</th>
<th>Attribute Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location: Wisconsin</td>
<td>Cash Crop: Corn - Grain</td>
<td>Soil Type: Well Drained</td>
<td>flooding: No</td>
</tr>
<tr>
<td>Plant Date: 04/30/2015</td>
<td>Harvest Date: 10/15/2015</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Attribute Ratings:
- 1: Poor
- 2: Fair
- 3: Good
- 4: Excellent

**Reliable Establishment**
- Weed Fighter: Setting 1
- Soil Builder: Setting 1
- Nitrogen Scavenger: Setting 1

**Freeze Risk to Establishment**
- Weed Fighter: Setting 1
- Soil Builder: Setting 1
- Nitrogen Scavenger: Setting 1

**Frost Seeding**
- Weed Fighter: Setting 1
- Soil Builder: Setting 1
- Nitrogen Scavenger: Setting 1

**Cash Crop Growing Period:** Requires Aerial Seeding or Interseeding of Cover Crop

**Nonlegumes**
- Barley, Spring 2: Setting 1
- Barley, Winter 2: Setting 1
- Buckwheat 2: Setting 1
- Chlorella (part of a mix) 2: Setting 1
- Millet, Japanese 3: Setting 1
- Millet, Pearl 3: Setting 1
- Oats 3: Setting 1
- Rye, Winter Cereal 4: Setting 1
- Ryegrass, Annual 3: Setting 1
- Songhym-sudangrass 4: Setting 1
- Sudangrass 4: Setting 1
- Sunflower (part of a mix) 2: Setting 1
- Triticale, Winter 3: Setting 1
- Wheat, Spring 3: Setting 1
- Wheat, Winter 3: Setting 1

**Brassicas**
- Radish, Oriseola 2: Setting 1
- Rapseed, Canola 2: Setting 1
- Turnip, Forage type 3: Setting 1

**Legumes**
- Clover, Berseem 2: Setting 1
- Clover, Crimson 2: Setting 1
- Clover, Red 3: Setting 1
- Cowpea 2: Setting 1
- Pea, Forage 4: Setting 1
- Pea, Winter 2: Setting 1

**Mixes**
- 40% W Pea/60% Oats: Setting 3
- 50% Br Clover/50% Oats: Setting 2
- 50W V/R/50% W Chalk: Setting 3
- 60% V Pea/40% Oats: Setting 1
- 60% Oats: Setting 2

Select cover crop to create information sheet: 40% W Pea/60% Oats
Submit
**40% W Pea/60% Oats Information Sheet**

**Considerations for using 40% W Pea/60% Oats in Wisconsin**

There are no special considerations.

Links to information on using Cover Crops in Wisconsin can be found at [http://mcoc.msu.edu/states/Wisconsin.html](http://mcoc.msu.edu/states/Wisconsin.html)

### Location Information
- **Location:** Wisconsin
- **Cash Crop:** Barley
- **Plant Date:** 04/10/2012
- **Harvest Date:** 10/15/2012
- **Soil Drainage:** M-D
- **Artificial Drainage:** No
- **Flooding:** No

### Cover Crop Selection Information
- **Cover Crop Selected:** 40% W Pea/60% Oats
- **Cover Crop Attribute #1:** None
- **Cover Crop Attribute #2:** None
- **Cover Crop Attribute #3:** None

### Planting Information
- **Drilled Seeding Depth:** 1.5 - 2.0 in.
- **Drilled Seeding Rate:** 15 - 18 lbs/PL
- **Broadcast Seeding Rate:** 15 - 18 lbs/PL
- **Broadcast Seeding Rate:** 18 - 22 lbs/PL
- **Air Seeding Rate:** 15 - 18 lbs/PL
- **Seeding Count:** 1,440
- **Seed Count:** 1,680
- **Frost Seed:** No
- **Fly-free Date:** No
- **Inoculation Type:** None

### Termination Information
- **Termination Methods:** Winter Killing

### Cultural Traits
- **Scientific Name:** Pisum sativum, Lathyrus sativus
- **Scientific Name:** Lolium multiflorum
- **Life Cycle:** Annual or Winter Annual
- **Growth Habit:** Upright to Semi-upright
- **PREFERRED Soil pH:** 6.0
- **Min. Germination Temp.:** 41°F
- **Heat Tolerance:** Fair
- **Drought Tolerance:** Fair
- **Shade Tolerance:** Good
- **Flood Tolerance:** Fair
- **Low Fertility Tolerance:** Good
- **Winter Survival:** Under 10°F

### Potential Advantages
- **Soil Impact - Substrate:** Good
- **Soil Impact - Flourish:** Good
- **Soil Ecology - Nematodes:** Very Good
- **Soil Ecology - Disease:** Fair
- **Soil Ecology - Alkalinity:** Fair
- **Soil Ecology - Choke Weeds:** Excellent
- **Other - Attract Beneficials:** Good
- **Other - Bees Traffic:** Good
- **Other - Short Windows:** Excellent

### Potential Disadvantages
- **Delayed Emergence:** Occasionally a minor problem
- **Invasive Weed Potential:** Very Low
- **Increased Insects/Nematodes:** Should be a major problem
- **Increased Crop Diseases:** Occasionally a minor problem
- **Hinders Crops:** Occasionally a minor problem
- **Establishment Challenges:** Occasionally a minor problem
- **Mature Incorporation:** Occasionally a minor problem

### Additional Information
- Additional Information from Managing Cover Crops
  - Profanity 3rd Edition. Edited by Andy Clark, Sustainable Agriculture Network
  - Winter
  - Oats
- **Other Resources**
  - Wisconsin: Pea and Small Grain Mixtures
  - Wisconsin: Pickling Alfalfa’s Partner
  - Out of Range: Soil pH Fail for Haying in Central North Dakota
Available for purchase at Purdue Education Store $5.00 + shipping
Available for free pdf download through SARE. Also can purchase for $19.00 + shipping
http://www.sare.org/Learning-Center/Books/Managing-Cover-Crops-Profitably-3rd-Edition
RYE

 Secale cereale

 **Also called:** cereal rye, winter rye, grain rye

 **Type:** cool season annual cereal grain

 **Roles:** scavenge excess N, prevent erosion, add organic matter, suppress weeds

 **Mix with:** legumes, grasses or other cereal grains

 See charts, pp. 66 to 72, for ranking and management summary.

**The hardest of cereals, rye can be seeded later in fall than other cover crops and still provide considerable dry matter, an extensive soil-holding root system, significant reduction of nitrate leaching and exceptional weed suppression.** Inexpensive and easy to establish, rye outperforms all other cover crops on infertile, sandy or acidic soil or on poorly prepared land. It is widely adapted, but grows best in cool, temperate zones.

Taller and quicker-growing than wheat, rye can serve as a windbreak and trap snow or hold rainfall over winter. It overseeds readily into many high-value and agronomic crops and resumes growth quickly in spring, allowing timely killing by rolling, mowing or herbicides. Pair rye with a winter annual legume such as hairy vetch to offset rye’s tendency to tie up soil nitrogen in spring.

**Benefits**

**Nutrient catch crop.** Rye is the best cool-season cereal cover for absorbing unused soil N. It has no taproot, but rye’s quick-growing, fibrous root system can take up and hold as much as 100 lbs. N/A until spring, with 25 to 50 lbs. N/A more typical (422). Early seeding is better than late seeding for scavenging N (46).

- A Maryland study credited rye with holding 60 percent of the residual N that could have leached from a silt loam soil following intentionally over-fertilized corn (372).
- A Georgia study estimated rye captured from 69 to 100 percent of the residual N after a corn crop (220).
- In an Iowa study, overseeding rye or a rye/oats mix into soybeans in August limited leaching loss from September to May to less than 5 lb. N/A (313).

Rye increases the concentration of exchangeable potassium (K) near the soil surface, by bringing it up from lower in the soil profile (123).

Rye’s rapid growth (even in cool fall weather) helps trap snow in winter, further boosting winterhardiness. The root system promotes better drainage, while rye’s quick maturity in spring—compared with other cover crops—can help conserve late-spring soil moisture.

**Reduces erosion.** Along with conservation tillage practices, rye provides soil protection on sloping fields and holds soil loss to a tolerable level (124).
Following Crop

- Following crop may be suppressed if cover crop is not properly terminated
2014 Spring termination data indicated 100% control possible at lower rates (16-22 fl oz) of glyphosate (4.5 lb ae/a) applied when the crops are under 6 inches in height.

As crop quickly grows 100% control becomes impossible at low rates.

Consider Weather conditions.
Annual Ryegrass Recommendations

- Recommended control once crop is above 6 inches
  32 fl oz/a glyphosate (4.5 lb ae/a)
- May require multiple applications
- Tank mixes may antagonize control
- Remember annual ryegrass is not always winter hardy in WI
• 2014 Spring termination data indicated 100% control only possible at lower rates (16-22 fl oz) of glyphosate (4.5 lb ae/a) when the crop is below 18 inches or prior to boot stage
• Crop grows very quickly
• Typically control is desired when crop is vegetatively growing and is more difficult to control
Winter Rye Recommendations

- Recommended control once crop is above 18 inches is to apply 32 fl oz/a glyphosate (4.5 lb ae/a)
- May require multiple applications
- Winter rye is winter hardy in WI
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Questions?