

# Cover Crops for Weed Management: Termination



## Overview

- Terminating, or killing, cover crops using the right methods in the right time frame is important to ensure maximum cash crop yield. Excessive competition from the cover crops can hinder early growth of cash crops and increase risk of yield reduction.
- Cover crops can be terminated before or after cash crop planting, depending on crop rotation and grower preference.
- Cover crop species, growth stage, weather and cover cropping goals should all be considered when planning a termination method and timing. These decisions require a balance between growing the cover long enough to maximize benefits and terminating in time to avoid negatively affecting the following cash crop.



Figure 1. Soybeans growing through cereal rye residue. Photo Credit: Meaghan Anderson, Iowa State University.

- Biomass and ground cover are two main drivers of weed suppression by cover crops. Studies have shown that out of all the management factors, termination timing has the greatest influence on biomass production.
- Delayed termination in the spring can increase cover crop biomass production. Planting the cash crop as close to termination as possible can increase cover crop residue persistence by slowing the rate of degradation. The high carbon-to-nitrogen ratios found in the vegetation of cereal crops such as rye can also increase longevity of residue, which can lengthen the window of weed suppression.

## Termination Method

### Natural

- The use of winter-killed cover crop species can simplify spring management. Summer- and fall-planted cover crops that die naturally over the winter in much of the Midwest include oats, sorghum-sudangrass, tillage and oilseed radish, turnips and winter peas (if planted before September in cool regions). On occasion, some species, such as radish and winter pea, can survive the winter. It is best to have a management plan for termination of these species in the event of survival.
- The use of species that winter-kill provides a shorter period of soil protection, especially if planted after a late harvest. Weed suppression is also primarily limited to winter annual weed species. For this reason, species that winter-kill are often included in some sort of species mixture with grass or legume species that overwinter in order to provide weed suppression and soil protection in the spring.

### Mechanical

- Mechanical means of cover crop termination include tillage, rolling/crimping and mowing.
- Tillage from field cultivators can terminate a cover crop by burying the plant residue and cutting the roots. Vertical tillage is a less effective termination option, and many types of tillage may require multiple passes to achieve the desired level of control. Strip-tillage can be performed to break up residue and increase soil warming in the row. Termination via tillage speeds up the breakdown of residue and incorporates it into the soil. In general, this method of termination can negate some of the benefits associated with using cover crops.

- A roller-crimper can be used to control some cover crop species, but doing so at the right stage based on species is critical for complete termination. Cereal rye can be rolled after pollen shed to form a dense mat of residue. This residue is capable of suppressing weeds and conserving soil moisture in the hot summer months. Hairy vetch can be rolled in full bloom just before corn planting.
- The roller-crimper may be suitable for organic operations looking for less soil-intensive means of weed suppression. The use of multi-species mixes can complicate this method of termination, as the different species often require termination at different times due to varying maturation rates. In these instances, it is best to time the roller-crimp operation according to the latest-maturing species.
- Mowing is generally less effective than tillage or roller-crimping, with unpredictable effectiveness and regrowth of some species.

#### Chemical

- Termination with herbicides is reliable when the appropriate herbicide rate is applied at the correct cover crop growth stage. **Refer to the label for rate and adjuvant recommendations.**

#### Grasses

- In general, grass species such as wheat, barley, rye, oats and annual ryegrass can be controlled with glyphosate alone or mixes that include glyphosate. Systemic herbicides such as glyphosate are most successful when applied on warm, sunny days when plants are actively growing. Recent research showed that for these grass cover crop species, glyphosate alone or glyphosate plus 2,4-D, saflufenacil or clethodim was most effective.<sup>1</sup> Termination treatments applied before the boot stage for grass species typically result in maximum control.
- Control of grasses with paraquat and glufosinate often declines four weeks after application when they begin regrowing, relative to the longer-term effectiveness of glyphosate.<sup>2</sup>
- It is often recommended that cereal rye be terminated 10 to 14 days before corn planting to reduce the effects of competition for nitrogen on the corn crop.
- Soybeans are generally less prone to be compromised by cereal rye, and some growers successfully plant into a growing stand of rye. As with all new practices, it is important to start experimenting on a small scale.
- Despite popularity in some regions of the U.S., annual ryegrass is generally not recommended for use as a cover crop by weed scientists. Use caution when considering annual ryegrass as a cover crop species, as it is especially aggressive and can escape chemical control. It is also more difficult to terminate with glyphosate than wheat, barley,

oats or cereal rye, and requires the addition of clethodim in some regions.

- **Applying burndown herbicides just prior to cereal rye harvest for ryelage is illegal.** Rye harvested for forage is best managed with a post-harvest herbicide application of glyphosate.<sup>3</sup>

#### Broadleaves

- Non-selective contact herbicides such as paraquat and glufosinate can also be used to terminate cover crops and can be especially beneficial in cool springs. The key to successful termination with contact herbicides is complete coverage and including other herbicides in the mix that improve effectiveness.
- Legume species such as Austrian pea, crimson clover and hairy vetch are most effectively controlled with a mix of actives that includes either paraquat or glyphosate.<sup>2</sup> Hairy vetch and crimson clover can also be controlled with 2,4-D.
- Recent multistate research on cover crop termination showed that applications incorporating glyphosate were more effective compared with applications that included paraquat or glufosinate. For broadleaf cover crop species, glyphosate, paraquat or glufosinate applied with either 2,4-D or dicamba was most effective.<sup>1</sup>

#### Keep in Mind

- When making an herbicide plan, keep in mind that antagonism can occur if glyphosate and glufosinate are applied together. Grass control is occasionally compromised when a growth regulator herbicide is added to glyphosate. A follow-up POST treatment of growth regulator herbicide and/or glyphosate in corn and certain soybean trait systems can complete control of covers that are only partially controlled by a burndown treatment.
- Residual herbicides can be integrated into cover crop termination applications to reduce the need for additional field passes. Preplant and POST-termination applications that include a residual can provide effective cover crop termination and residual weed control. There is generally a greater weed control benefit, and herbicide options are more numerous, from including the residual in preplant applications compared with inclusion in the POST application.



Figure 2. Effect of termination timing on cereal rye biomass in soybeans. Kolby Grint, University of Wisconsin-Madison.<sup>5</sup>

- Timing of termination and levels of biomass are often determined by the goals of the cover crop and will impact the amount of residual product that reaches the soil. If high biomass is the goal, it is possible to terminate late and save the residual herbicide for use in the POST application,<sup>4</sup> keeping in mind that POST-residual options in season are limited for soybeans.

## Herbicide Recommendations by Species

### Cereal Rye

- Generally easy to kill.
- Glyphosate up to 18 inches.
  - Base rate: 0.75 lb. ae/A
  - Increase the rate on tall rye or in cool conditions.
  - Possible antagonism with residual herbicides.

### Winter Wheat

- Tougher to kill than cereal rye.
- Glyphosate up to 18 inches.
  - Base rate: 1.1 to 1.5 lb. ae/A
  - Increase rate on taller wheat.
  - Possible antagonism with residual herbicides.
  - Most effective when applied alone in water.
  - Control is most complete when plants are small.

### Hairy Vetch and Winter Pea

- Generally easy to kill.
- Glyphosate plus 2,4-D or dicamba.
  - Glyphosate: 0.75 to 1.1 lbs. ae/A
- Gramoxone is effective on larger hairy vetch.
  - Add 2,4-D and/or dicamba.

### Clover and Alfalfa

- Can be challenging to terminate.
- Glyphosate plus 2,4-D or dicamba.
  - Glyphosate: 1.1 to 1.5 lbs. ae/A
- Clopyralid is very effective on these species.
  - SureStart<sup>®</sup>, TripleFLEX<sup>®</sup>, Hornet<sup>®</sup>, Stinger<sup>®</sup>
- Can kill larger crimson clover with 2,4-D.

## Termination Timing

### Before Cash Crop Planting

- Historically, most cover crops were terminated before planting in order to avoid competing with the cash crop, but this does result in less biomass production compared to termination after planting. Smaller plant size at the time of termination can allow for increased effectiveness of the burndown herbicides.

### After Cash Crop Planting

- Recently, growers have been experimenting with “planting green,” or terminating cover crops after cash crop planting. This delayed termination increases biomass production potential of the cover crop, which can provide additional weed suppression compared to early-killed cover crops.
  - A study in the Midwest found that terminating rye or wheat one week after planting increased biomass over 200% compared to termination one week before planting. Horseweed biomass was lower when cover crops were terminated after soybean planting, compared with no cover. Late-terminated cereal cover crops provided more consistent weed suppression than early-terminated.<sup>6</sup>
- Termination of cover crop plants at later maturity stages may be more challenging. Proper herbicide selection and application are important to ensure effective termination in these late-killed systems.
- Deciding when and how to terminate is one of the most important management decisions when using cover crops. Growers should also consult with insurance providers to confirm termination options and requirements.

## Summary

- Grass cover crop species are most effectively terminated with glyphosate applied alone or with saflufenacil.
- Broadleaf cover crops are most consistently terminated by mixtures of glyphosate with 2,4-D, dicamba or saflufenacil.<sup>7</sup>

### CITATIONS

<sup>1</sup>Whalen D, Bish M, Young B, Conley S, Reynolds D, Norsworthy J, Bradley K. (2019). Herbicide programs for the termination of grass and broadleaf cover crop species. *Weed Technol* 34:1-10.

<sup>2</sup>Pittman K, Cahoon C, Bamber K, Rector L, Flessner M. (2019). Herbicide selection to terminate grass, legume, and brassica cover crop species. *Weed Technol* 34:48-54.

<sup>3</sup>Wallace J, Lingenfelter D. (2021). Preplant Burndown Herbicide Programs for Corn and Soybean. <https://extension.psu.edu/pre-plant-burndown-herbicide-programs-for-corn-and-soybean>

<sup>4</sup>Whalen D, Shergill L, Kinne L, Bish M, Bradley K. (2019). Integration of residual herbicides with cover crop termination in soybean. *Weed Tech* 34:11-18.

<sup>5</sup>Grint K, Smith D, Arneson N, DeWerrf R, Conley S, Werts R. (2020). 2020 Considerations for Cover Crop Termination. <https://www.wiscweeds.info/post/2020-considerations-for-cover-crop-termination/>

<sup>6</sup>Schramski JA, Sprague CL, Renner KA. (2020). Effects of fall-planted cereal cover-crop termination time on glyphosate-resistant horseweed (*Coryza canadensis*) suppression. *Weed Technol* doi: 10.1017/wet.2020.103.

<sup>7</sup>Cornelius CD, Bradley KW. (2017). Herbicide Programs for the Termination of Various Cover Crop Species. *Weed Technol* 31:514-522.

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