

# Management of Italian Ryegrass in Agronomic Crops

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## Introduction

Italian ryegrass [*Lolium perenne* L. ssp. *multiflorum* (Lam.) Husnot] has become an increasingly weedy and invasive species for production agriculture in Arkansas. Individual plants can become highly competitive producing up to 108 to 173 tillers per plant and 20,500 to 45,000 seeds per plant. It is a short, cool-season winter annual or biennial bunch grass which grows vigorously in the winter and early spring. The ideal environment for Italian ryegrass to germinate is when temperatures are between 68 and 77°F and there is adequate soil moisture (Washington State University Extension 2020). Typically, germination will then occur within six to 10 days and may occur in the fall or in the spring. Italian ryegrass establishes with ease and grows rapidly if no action is taken to prevent it. This can lead to decreased yields in corn (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), rice (*Oryza sativa* L.), soybean (*Glycine max* L. Merr.), and other crops. There are several preventative methods available during the fall, but after emergence, it is more challenging to kill the weed due to herbicide resistance.

## Identification

Italian ryegrass appears very similar to perennial ryegrass (*Lolium perenne* L.). It may grow upwards of 2 to 3 feet tall. Plants will grow in a bunch form with many long, narrow, stiff leaves which are red near the base setting it apart from perennial ryegrass



**Figure 1.** Italian ryegrass seedling.



**Figure 2.** Italian ryegrass seed head with alternating arrangement of spikelets. Photo courtesy of Graham Calow and Nature Spot (<https://www.naturespot.org.uk/species/italian-rye-grass>).

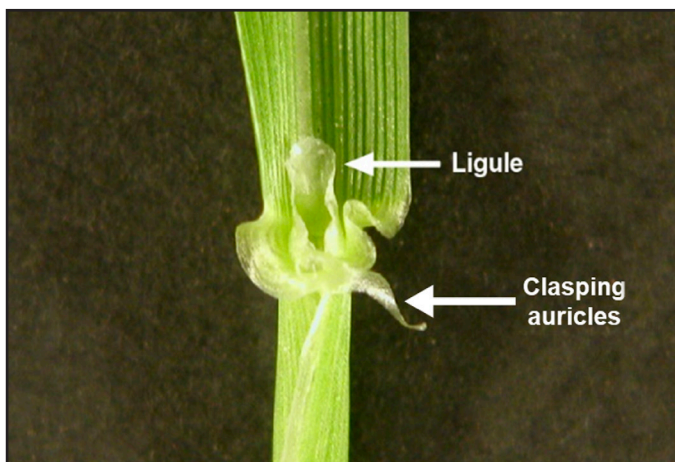
(Fig. 1). Leaf blades range from 3/16 to 7/16 inches wide and 2 to 8 inches long, with a bright, glossy, and smooth appearance (hairless) on the underside. The keys to identification of ryegrass species are the spikelets, awns and glumes. The seed head has 5 to 38 spikelets alternately arranged up the stem (Fig. 2). Italian ryegrass spikelets have awns or bristles about 3/16 inch

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**Figure 3.** Closeup of spikelets on an Italian ryegrass seed head. The circled area shows the characteristic awns on a spikelet. Photo courtesy of Graham Calow and Nature Spot (<https://www.naturespot.org.uk/species/italian-rye-grass>).



**Figure 4.** Italian ryegrass ligule and clasping auricles. Photo courtesy of Oklahoma State University.

long with a short glume, while perennial ryegrass spikelets are awnless (Fig. 3). In Italian ryegrass, leaves in the shoot are rolled, unlike perennial ryegrass leaves, which are folded in the shoot. Italian ryegrass also has a membranous ligule with clasping auricles (Fig. 4), whereas perennial ryegrass auricles are non-clasped. For more details on the identification of Italian ryegrass and other ryegrass species, please see FSA2149, Ryegrass Identification Keys, which can be found here: <https://www.uaex.uada.edu/publications/PDF/FSA-2149.pdf>.

## Cover Crop

With an increasing use of winter cover crops for soil management and weed suppression, cereal rye (*Secale cereale* L.) and ryegrass have become common species planted for this purpose. Research has shown cereal rye to be easily controlled with herbicides, specifically glyphosate, prior to

the establishment of the subsequent cash crop. However, ryegrass can be extremely difficult to effectively kill and has shown a proclivity to evolving herbicide resistance. Glyphosate-resistant ryegrass at times can contaminate purchased ryegrass seed planted as a cover crop. For these reasons, the University of Arkansas System Division of Agriculture recommends using cereal rye as a cover crop species or in a mixture, as ryegrass will quickly result in a weedy problem for subsequent agronomic crops. Some cover crop seed companies refer to both cereal rye and ryegrass simply as “rye”, so make sure the seed intended for planting is actually cereal rye and not ryegrass. Cereal rye seed is short, compact and dense similar to wheat, while ryegrass seed is long, skinny, less dense and hollow compared to cereal rye (Fig. 5).

## Herbicide Resistance

Since the 1980s, control of Italian ryegrass has become more problematic due to resistance to five herbicide sites-of-action in the United States (Heap 2020). These resistances include:

- Group 1 - ACCase-inhibitors [diclofop (Hoelon), fluazifop (Fusilade), quizalofop (Assure II), and clethodim (Select Max)],
- Group 2 - ALS-inhibitors [nicosulfuron (Accent), mesosulfuron (Osprey), pyroxsulam (PowerFlex HL), rimsulfuron + thifensulfuron (Resolve)],
- Group 9 - EPSPS-inhibitors [glyphosate (Roundup)],
- Group 10 - glutamine synthetase inhibitors [glufosinate (Liberty)], and
- Group 15 - long chain fatty acid elongase inhibitors [S-metolachlor (Dual Magnum), pyroxsulfone (Zidua), acetochlor (Warrant)].

Ryegrass samples from fields with ryegrass control failures across various states in the US (primarily from the Mid-South and Southeast) showed



**Figure 5.** Comparison of cereal rye seed (left) versus ryegrass seed (right). Only cereal rye is recommended for use as a cover crop.



87% had diclofop (Hoelon) resistance as of 2011 (Salas et al. 2013). One-fourth of diclofop-resistant populations were cross-resistant to pinoxaden (Axial) and 81% were resistant to at least one ALS-inhibiting herbicide.

**In Arkansas**, Italian ryegrass has been confirmed resistant to ALS-inhibitors, ACCase-inhibitors (FOPs and pinoxaden), and glyphosate (Dickson et al. 2011; Kuk et al. 2007, 2008). The resistance pattern was similar to that of other states in the Mid-South. The primary problem originally was resistance to diclofop (81% of populations), about 80% of which were cross-resistant to other FOPs and 20% were cross-resistant to pinoxaden. As of 2012, 65% of Italian ryegrass samples that had been screened in Arkansas were reported as ALS-inhibitor-resistant (Dickson 2012). Since then, reports of ALS-inhibitor resistance have continued to increase across the state. The most common resistance with ALS-inhibiting herbicides involve the sulfonylureas, mesosulfuron (Osprey) and sulfometuron (Oust). However, cross-resistance to pyroxsulam (PowerFlex HL) and imazamox (Beyond) has also been confirmed. Initially, glyphosate resistance was localized to south Arkansas; however, glyphosate-resistant Italian ryegrass progresses farther north each year, with recent failures in some of the most northern counties in the state. Ryegrass has also been confirmed resistant to the ACCase-inhibitor clethodim (Select Max) in Mississippi (Bond 2018) and has been unofficially verified as resistant in south Arkansas. With the loss of all ACCase-inhibitors, ALS-inhibitors, and glyphosate as Italian ryegrass control options due to herbicide resistance, minimal herbicide options remain for effective control. Therefore, multiple tactics will be required using an integrated weed management approach.

## Control Strategies

### Tillage

Fall tillage can be used as an effective control strategy, especially by eliminating the initial flush of Italian ryegrass. Previous research has shown eliminating the first flush of Italian ryegrass in the fall will drastically reduce the number of plants that must be controlled by postemergence herbicides in the spring. When considering tillage as a management option, it is important that emerged weeds are completely killed and clods behind the disk must be fully crumbled and turned over. It is vital to use fall tillage when the ryegrass seedlings are small to increase the effectiveness of this management strategy. Fall tillage can play an important role in the management of Italian ryegrass, but it must be part of a program approach followed by multiple herbicide applications to achieve complete control.

### Preemergence

The best control strategies aim to prevent Italian ryegrass from emerging using residual grass herbicides such as Dual Magnum (*S-metolachlor*), Command (clomazone), incorporated Treflan (trifluralin), or Zidua SC (pyrooxasulfone), applied in the fall between mid-October through November. These products are preemergence herbicides, which require application before weeds have emerged. If some Italian ryegrass has already emerged, it is best to apply paraquat with the residual herbicides during the fall application. Some fall-applied residuals may have plant-back restrictions and can injure the following cash crops. Research from Mississippi State University evaluated the four herbicides listed above applied at label rates in the fall ahead of rice seeding the following spring. Of the four, clomazone was the only product that did not cause injury and rice yield reduction (Lawrence et al. 2018). Please see MP519 Row Crop Plant-Back Intervals for Common Herbicides (<http://bit.ly/MP519-PlantBack>) for more information regarding plant-back restrictions.

### Postemergence

Complete control of Italian ryegrass will require a spring burndown herbicide application following fall applications and tillage. Relying on postemergence options alone is not advisable as it is often much more difficult to achieve complete control, expensive, and hastens the evolution of herbicide resistance. The following postemergence herbicide recommendations should provide the greatest control in or ahead of each cropping system.

- **In wheat:** ALS-inhibitor-resistant Italian ryegrass should be managed with a fall application of Axiom (6-10 oz/A dependent on soil type) plus Prowl (2.1 pt/A) or Zidua SC (1.25-4 fl oz/A) or Anthem Flex (2-4 fl oz/A) followed by Axial XL (16.4 fl oz/A) or Axial Bold (15 fl oz/A) in the spring (Fig. 6). If Italian ryegrass is not ALS-inhibitor-resistant, Osprey (4.75 oz/A) or PowerFlex HL (2 oz/A) remain good options for the spring postemergence application.
- **In cotton, soybean and peanut:** Early spring burndown applications of a graminicide such as clethodim (Select Max) (12 to 16 fl oz/A) or glyphosate (if not glyphosate-resistant) (32 fl oz/A) should be applied when Italian ryegrass is no more than 4 to 6 inches tall. Keep in mind that the majority of Italian ryegrass populations in the southern half of the state are glyphosate-resistant, and some are likely resistant to both glyphosate and clethodim. Once ryegrass populations turn reproductive or in instances where neither glyphosate nor clethodim

are expected to provide effective control, two applications of paraquat (Gramoxone) (3 to 4 pt/A dependent on formulation) will likely be needed prior to planting.

- **In corn and rice:** Italian ryegrass should be controlled prior to planting. If not controlled, research in Mississippi has shown glyphosate-resistant Italian ryegrass can negatively affect crop establishment and reduce corn yields as much as 60% at a density of 1.2 plants per row foot (Nandula 2014). Once corn or rice emerges, there are limited options for control of Italian ryegrass, especially if the population is ALS-inhibitor and glyphosate-resistant. Corn herbicides containing rimsulfuron (Leadoff, Steadfast Q) are very effective on non-ALS-inhibitor-resistant populations. Be aware, if using clethodim as an Italian ryegrass burndown, there is a 30-day plant-back restriction to both corn and rice. Glyphosate (if not resistant) or paraquat (3 to 4 pt/A dependent on formulation) are the best options for managing Italian ryegrass ahead of corn and may be the only option prior to planting rice.

**Paraquat** (3 to 4 pt/A dependent on formulation) is the most broad-spectrum herbicide option for control across cropping systems ahead of planting, especially in areas where Italian ryegrass is resistant to both glyphosate and ACCase-inhibitors, but it may require multiple applications. The addition of a photosystem II-inhibiting herbicide, such as metribuzin (soybean), diuron (cotton), or atrazine (corn), with paraquat can enhance ryegrass control. Use of propanil (rice) in combination with paraquat prior to planting rice does not greatly improve control, and again, sequential applications of paraquat are recommended in this scenario. Leadoff (1.5 oz/A) has also shown to be an effective tank-mixture partner with glyphosate in spring burndown applications for aiding



**Figure 6.** Example of the multiple herbicide applications necessary to effectively control Italian ryegrass in wheat. A single postemergence herbicide application applied in the spring (left) versus a residual herbicide applied preemergence in the fall followed by a postemergence herbicide applied in the spring (right).

Italian ryegrass control in populations that are not ALS-inhibitor and glyphosate-resistant; however, a 30-day plant-back interval is present for cotton and soybean, 45 days for peanut, and 10 months for rice. Additionally, it is recommended to plant STS or BOLT soybean following an application of Leadoff regardless of the planting interval.

For spring herbicide applications, it is best to spray during warm weather and when the weed is actively growing. If the weed reaches the joint growth stage (stem elongation), it is more challenging to kill. Additionally, if herbicides are applied during cool, cloudy and wet conditions, effectiveness may decrease.

## Integrated Weed Management Tips

Integrated weed management tactics, including cultural control strategies, should be used in addition to herbicides. Research has shown that harvest weed seed control with narrow-windrow burning or a weed seed destructor can be beneficial to reduce the return of weed seeds to the soil seedbank (Schwartz-Lazaro et al. 2016). When using narrow-windrow burning, it is critical that the chaff and seed be placed in these narrow windrows for an effective kill to occur; simply burning the wheat stubble is not effective as it is unable to reach temperatures great enough to kill the ryegrass seed. No seeds equal no weeds the following year. Research has shown that fallowing a field for one year and not allowing Italian ryegrass seed production resulted in a 95% reduction in the soil seedbank.

Crop rotation is also beneficial to allow for management strategies to be rotated. Management of Italian ryegrass on ditch banks, turn rows, and field borders should also be considered to prevent the further spreading of seed by equipment traffic or water. It is important to use full-labeled herbicide rates, make applications during favorable weather conditions, and use good spraying practices to help ensure the greatest likelihood of success. Close attention should be paid to spray coverage; it is recommended to select and use an appropriate nozzle, spray pressure, and spray volume to achieve adequate coverage to maintain herbicide effectiveness. And as always, read and follow the product label.

## Additional Resources

University of Arkansas System Division of Agriculture Research and Extension MP44.  
<http://bit.ly/UAEX-MP44>.

Italian Ryegrass. <http://iwilltakeaction.com/weed/italian-ryegrass>.

Italian Ryegrass: Different Control Methods – Video <https://integratedweedmanagement.org/index.php/2019/11/12/could-italian-ryegrass-be-defeated-with-an-iwm-plan/>

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