GWC-14

The Glyphosate, Weeds, and Crops Series

Biology and Management of Common Ragweed

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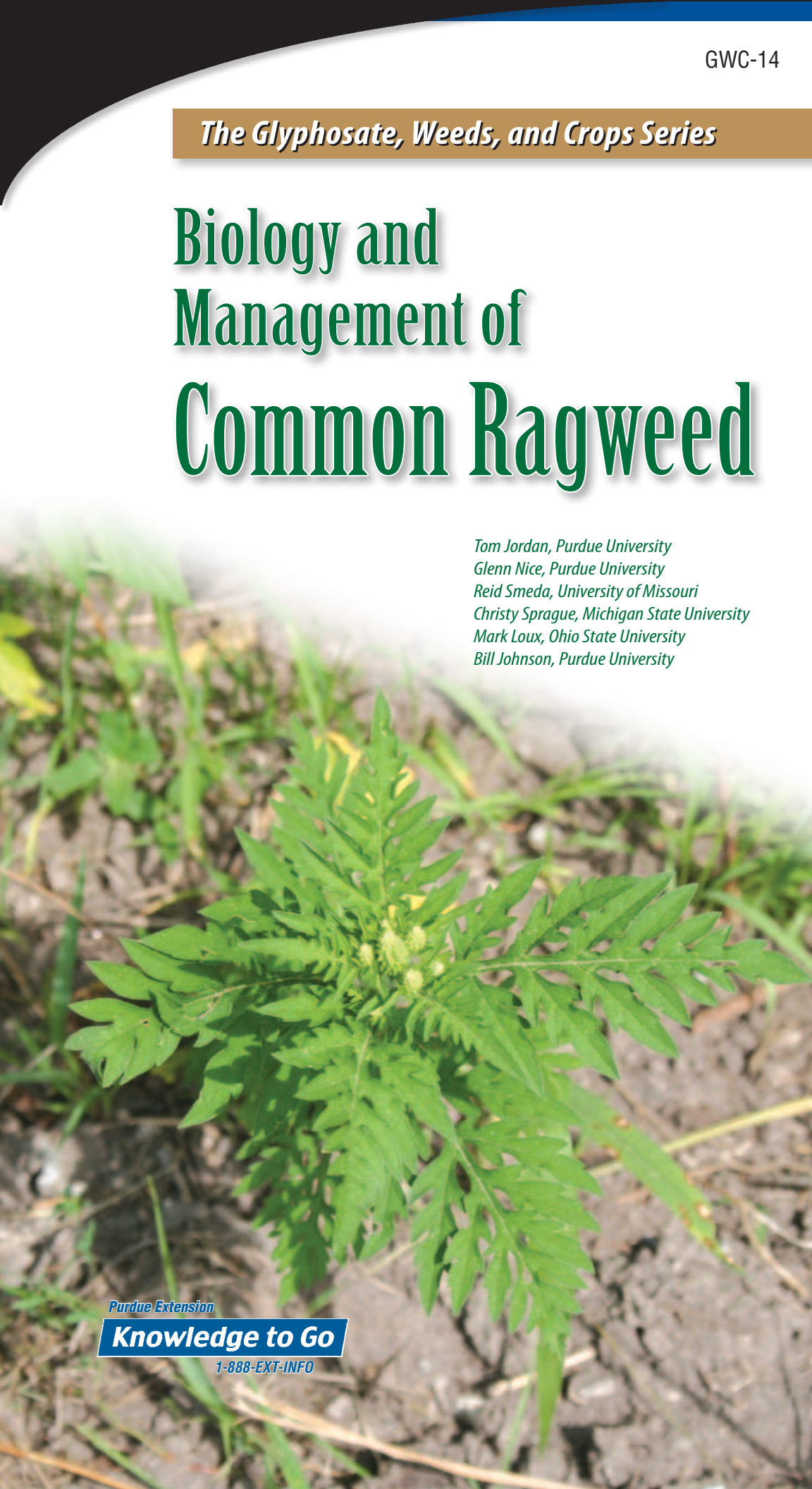

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This publication was reviewed and endorsed by the *Glyphosate, Weeds, and Crops* Group. Members are university weed scientists from major corn and soybean producing states who have been working on weed management in glyphosate-resistant cropping systems.

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Biology and Management of Common Ragweed

Common ragweed (*Ambrosia artemisiifolia*) is also known as hayfever weed, bitterweed, wild tansy, annual ragweed, or blackweed. The weed is found in many agricultural settings, but is most prevalent in corn and soybean fields using reduced or no-till practices, and in low-fertility fields. Its ability to thrive in low-fertility soil and preference for undisturbed seedbeds combine to make common ragweed an ideal weed species for invading no-till soybean and wheat fields in the North Central region.

Over the past several years, common ragweed biotypes have developed resistance to herbicides, which make it even more difficult to control.

This publication will examine the biological characteristics of common ragweed that make it a troublesome weed. It also will outline management practices that will help growers better manage the weed and slow the selection of biotypes with herbicide resistance.

Identification

Common ragweed is a native summer annual found throughout North America, but is prevalent in northern latitudes of the eastern United States and southeastern Canada. It grows as tall as 3 to 6 feet and branches frequently when population densities are low. It has a shallow taproot that produces a fibrous root system. The plant produces abundant pollen, which is a primary cause of hay fever.

Its hairy stems are green to light pinkish red. The leaves are up to 6 inches long and 4 inches across, and have an opposite or alternate arrangement along the stem (Figure 1). The leaves are compound, deeply cut into a number of lobes, and usually much wider at the base than the tip. Mature leaves are relatively hairless, but small, emergent leaves often have hairs on their undersides — in some biotypes they will remain hairy throughout the growing season.

Figure 1. *Common ragweed leaves have an opposite or alternate arrangement along the stem.*

Many of the upper stems terminate in one or more cylindrical flower spikes that are about 1 to 4 inches long (Figure 2). One or two small spikes may develop near the base of the central towering spike, and are only half as long as the main spike. Common ragweed's small flowers are initially green, but turn yellowish green or brown as they mature and develop into seed clusters.

Common ragweed produces male and female flowers in separate heads on the same plant. The male flowers, usually drooping, are at the top of the plant. The female flowers are in the upper canopy at the bases of leaves. Each flower is about 1/8 inch long and the males produce small yellow pollen that is easily carried by the wind. Plants usually release pollen in late summer or early fall. Individual plants can produce in excess of 1 billion pollen grains.

Figure 2. *Common ragweed's cylindrical flower spikes are about 1 to 4 inches long.*

Growth, Development, and Seed Production

Before common ragweed seeds can germinate, they must first go through a dormant period — late fall through winter — before germinating in late April through May the following year. Rising temperatures promote germination, but hot temperatures, like those that prevail in July, will halt germination and send the seeds back into dormancy until they repeat the cold requirement the following winter.

Most common ragweed seeds germinate on or very near the soil surface. Seeds deeper in the soil profile need tillage to bring them to the soil surface to induce germination. Research has shown that a combination of light and temperature are involved in the germination process.

The seed of different common ragweed biotypes can respond differently to day length and temperatures depending on their latitude of origin. Seeds from northern latitude biotypes tend to germinate and emerge earlier than those from southern latitudes. Plants that emerge mid-April through May can produce up to three times the seeds and biomass as plants that germinate in mid- to late June. Common ragweed plants allowed to grow for the entire growing season can produce 32,000 to 62,000 seeds per plant.

However, late-emerging plants may produce only a fraction of this number, because flowering is related to length of day. Common ragweed will flower, regardless of size, when days are short. A plant's seed production is proportional to its biomass.

Interference and Competition

If it isn't controlled before planting, common ragweed's early-season germination allows it to interfere with crop growth in no-till fields. This is more of a problem in soybeans than in corn, which grows taller and has more herbicide options for control. How much common ragweed interferes with crops or reduces yields is related to its density and when it emerged relative to the crop.

Research shows that common ragweed, like many other weed species, will not reduce yields when the crop can grow under weed-free conditions for two to four weeks after emergence. However, when common ragweed emerges with the crop, yields can be reduced substantially. Common ragweed plants growing in the soybean row have reduced soybean yields up to 10 percent when present at densities as low as four common ragweed plants per 30 feet of row. Higher weed populations can reduce crop yields further. While late-emerging common ragweed plants may not reduce soybean yields, they can still produce a limited number of seeds to deposit in the soil seed bank.

Increased Prevalence

In addition to its early-season emergence, two factors are commonly mentioned as causes of increased common ragweed prevalence: the influence of stem-boring insects on herbicide efficacy, and herbicide resistance.

Stem-Boring Insects and Glyphosate Activity

Research has shown that giant ragweed plants infested with stem-boring insects are more likely to survive glyphosate treatments (see Purdue Extension publication GWC-12, *Biology and Management of Giant Ragweed*). We believe that a similar phenomenon can occur with common ragweed.

Many insect-infested giant ragweed plants appear to have dead tissue on their upper portions following glyphosate treatments, making it appear that the application was effective. However, new growth then appeared from the lower parts of the stems, allowing the weeds to survive. It appears that stem- and root-boring insects injure the plant's vascular system, which may prevent glyphosate from adequately translocating and killing the plant (Figure 3).

Herbicide Resistance

Before Roundup Ready® soybeans were widely available, ALS-inhibitors (such as Classic® and FirstRate®) and PPO-inhibitors (such as Cobra® and Flexstar®) were the primary tools for common ragweed control. Not surprisingly, extensive ALS-inhibitor use resulted in the development of ALS-resistant populations by 1996.

Figure 3. *A ragweed borer in the main stem of a common ragweed plant.*

While widespread adoption of Roundup Ready® soybeans slowed the overall increase in ALS resistance in common ragweed, it has continued to develop in fields where non-Roundup Ready® or non-GMO soybeans are grown. More recently, common ragweed control with Cobra® or Flexstar® has become problematic in some fields, and common ragweed biotypes with resistance to PPO-inhibitors have been identified in Ohio.

Glyphosate-resistant common ragweed has been identified in Missouri, Ohio, Indiana, and several other states. In greenhouse studies, plants from a Missouri population survived glyphosate applications of more than 4 lbs. ae/A (Figure 4). Common ragweed populations with multiple herbicide resistance (to glyphosate and ALS-inhibitors, or to PPO-inhibitors and ALS-inhibitors) have also been identified in Ohio.

Figure 4. *This photo shows a common ragweed seedling two months after being treated with glyphosate at 4 lbs. ae/A in a greenhouse study.*

Management Strategies

Common ragweed's characteristics make it difficult to consistently and effectively control with single applications of PRE or POST herbicides, or with multiple applications of herbicides that have the same mode of action (Figure 5). The most effective herbicide programs combine PRE and POST herbicide treatments, and two or more herbicide modes of action, especially in soybeans.

Although multiple POST glyphosate applications may still effectively control common ragweed in some Roundup Ready® soybean fields (especially where the soybeans are grown in rotation with non-Roundup Ready® crops), this approach creates maximum selection pressure for glyphosate-resistant weeds.

Effective common ragweed management programs should ensure consistently effective control, minimize interference with crops early in the growing season, minimize herbicide resistance, and minimize the soil seedbank of the weed.

The most effective common ragweed management programs:

- Control weeds that emerge prior to planting with tillage or preplant burndown herbicide applications.
- Apply preemergence herbicides with activity on common ragweed to reduce competition with crops, provide flexibility in the timing of POST herbicides, and minimize the need for a second POST glyphosate application.
- Apply POST herbicides before ragweed plants exceed 4 to 6 inches tall.
- Scout fields two weeks after the first POST application. Control escapes or plants that emerge after the initial POST application with a second POST application. Where needed, make the second POST application three to four weeks after the first, before plants grow too large.

Figure 5. *The common ragweed plants on the left show some damage from a POST glyphosate application. The photo on the right shows the same plants, fully recovered, at the end of the growing season.*

Herbicide Programs for Corn

Controlling Emerged Weeds at Planting

To effectively control emerged common ragweed with herbicides before corn emergence:

- Combine atrazine with one of the following: 2,4-D ester, dicamba, glyphosate, or paraquat.
- Apply Lexar® or Lumax®.
- Combine atrazine with either Hornet® or SureStart®.
- Combine 2,4-D ester or dicamba with either glyphosate (at least 0.75 lb. ae/A) or paraquat.
- Avoid using 2,4-D, glyphosate, or paraquat alone since control will likely be more variable compared to herbicide combinations.

When applying glyphosate alone, use a rate of 1.1 lbs. ae/A, and increase the rate to 1.5 lbs. ae/A in areas where plants are more than 6 inches tall. Where glyphosate resistance is suspected, combine glyphosate with either 2,4-D ester or dicamba. Increase paraquat rates with increases in weed size. See product labels for details.

PRE (Residual) Corn Herbicides

Adequate common ragweed control is possible with PRE corn herbicides, but moderate to high populations require combinations of PRE and POST herbicides. The most effective PRE herbicides include:

- Products that contain atrazine with one of the following: Hornet®, Balance®, Balance Flex®, Corvus®, Callisto®, or SureStart®
  Note: Balance®, Balance Flex®, and Corvus® are not registered for use in Michigan, Minnesota, and Wisconsin.
- Lumax® or Lexar®.

Include additional atrazine in any of these treatments to improve control, but do not exceed the maximum atrazine rates allowed for the soil type. Lower rates of these PRE herbicides can be used in a planned program of PRE followed by POST herbicides, but use rates that are high enough to provide at least several weeks of ragweed control. It is also possible to use atrazine or an atrazine-containing product alone, as long as the atrazine rate is not less than about 1.5 lbs. ai/A.

POST Corn Herbicides

Many POST broadleaf herbicides effectively control emerged common ragweed in corn. In areas where there are known ALS-resistant populations, use an herbicide with a different mode of action, or combine ALS-inhibiting herbicides with herbicides that have a different mode of action, such as 5 oz./A of Status® or 6 oz./A of dicamba.

When applied following a PRE herbicide, effective POST herbicides include:

- dicamba or Status®.
- 2,4-D amine.
- Hornet®, Stinger®, or WideMatch®.
- atrazine plus one of the following: Buctril,® Callisto,® Impact,® or Laudis®.

- Steastfast ATZ® or Equip® plus one of the following: Callisto®, dicamba, Impact®, Laudis®, or Status®.
- Northstar® or Yukon®.
- Beacon® or Spirit® (except in ALS-resistant populations).
- Ignite® or Ignite® plus atrazine (in Liberty Link® corn only).
- glyphosate (in Roundup Ready® corn only).
- Lightning® plus one of the following: dicamba or Status® (in Clearfield® corn only).

In a total POST corn herbicide program, it is essential to apply herbicides when weeds are less than 4 inches tall. Such applications are usually early in the season, so include herbicides with substantial residual activity to control later-emerging plants. This usually involves adding atrazine to the POST treatment.

When using a total POST approach, apply:

- glyphosate plus atrazine or an atrazine premix product (in Roundup Ready® corn only).
- glyphosate plus either Lexar® or Lumax® (in Roundup Ready® corn only).
- Ignite plus atrazine® or an atrazine premix product (in Liberty Link® corn only).
- Lightning® plus atrazine (in Clearfield® corn only).
- Steadfast ATZ® plus one of the following: Callisto®, Impact®, or Laudis®.
- atrazine plus either Hornet® or SureStart®.

In these treatments, use an atrazine rate of at least 1 lb. ai/A. Remember, the total POST approach is far less effective for dense infestations than a combination of a PRE program followed with POST herbicides.

Herbicide Programs for Soybeans

Control of Emerged Weeds at Planting

For the most consistent preplant control of emerged common ragweed plants:

- Combine 2,4-D ester with either glyphosate or paraquat. Adding a product that contains chlorimuron (Canopy®, Envive®, Synchrony®, or Valor XLT®) or cloransulam (Authority First®, FirstRate® Gangster®, or Sonic®) can improve control if the population is not ALS-resistant. This is especially helpful when 2,4-D ester cannot be used because of its preplant interval.
- Avoid using 2,4-D, glyphosate, or paraquat alone, since control is likely to be more variable than with combinations of products.
- When applying glyphosate, use a rate of 1.1 lbs. ae/A, and increase the rate to 1.5 lbs. ae/A where plants are more than 6 inches tall. Increase Paraquat® rates as weed sizes increase. See product labels for details.

PRE (Residual) Soybean Herbicides

Preplant or PRE applications of Authority First®, Canopy®, Envive®, FirstRate®, Gangster®, Scepter®, Sonic®, Synchrony XP®, or Valor XLT®

can provide partial to adequate residual ragweed control. None of these herbicides is likely to provide adequate seasonlong control of dense populations, and they will not adequately control ALS-resistant populations. Products or combinations that include Valor® or high rates of metribuzin can partially control common ragweed, even ALS-resistant populations.

POST Soybean Herbicides

POST herbicides are most effective in fields that have been previously treated with PRE herbicides. Applying POST herbicides when common ragweed plants are less than 6 inches tall minimizes early-season interference with the crop and can provide the most effective control of existing weeds. In some cases, early POST applications may require a second POST application several weeks later to control late-emerging plants, but second applications are mostly needed where PRE herbicides were not previously applied.

When using glyphosate or FirstRate®, delaying the initial application may reduce the need for a second POST treatment, but be sure to make the application before ragweed plants exceed 6 to 8 inches tall.

Glyphosate and FirstRate® are generally the most effective POST herbicide treatments, except where populations are ALS- or glyphosate-resistant. For POST herbicide treatments in soybeans, apply:

- glyphosate at 1.1 lbs. ae/A on plants less than 6 inches tall; 1.5 lbs. ae/A on larger plants (for Roundup Ready® soybeans only).
- Ignite® or Ignite® plus either Cobra® or Flexstar® (Liberty Link® soybean only).
- Classic® or FirstRate® (except ALS-resistant ragweed populations).
- FirstRate® plus Flexstar®.
- Synchrony XP® applied at the STS soybean rate (except ALS-resistant populations).
- Cobra®, Flexstar®, or Phoenix® can be used if the population is ALS- or glyphosate-resistant. Ideally, apply when common ragweed is less than 4 inches tall.
- Basagran® plus either Reflex® or Cobra®.
- Raptor® or Pursuit® plus Cobra® (do not use in ALS-resistant populations).

Control in Fields with a History of Poor Glyphosate Performance

In fields where glyphosate has largely failed in the past, use an alternative to glyphosate for POST control of common ragweed, or mix glyphosate with full rates of an alternative product. We recommend the following strategy:

- Apply a preplant herbicide treatment consisting of 2,4-D ester, plus either glyphosate or Gramoxone®, plus a preemergence herbicide with residual activity on common ragweed (Authority First®, Canopy®, Envive®, FirstRate®, Gangster®, Scepter®, Sonic, or Valor XLT®).
- Apply one of the following POST treatments when common ragweed plants are no more than 4 to 6 inches tall:

- Flexstar® at 1.0 to 1.5 pints/A plus a POST grass herbicide, such as clethodim or Fusion®.
- Cobra® or Phoenix® (12.5 oz./A) can be substituted for Flexstar® and should be considered in Michigan, and parts of Kansas, Minnesota, North Dakota, South Dakota, and Wisconsin. Consider substituting where the maximum use rate of Flexstar® is 1 pint/A.
- Classic® or FirstRate® can be used instead of Cobra®, Flexstar®, or Phoenix® where the common ragweed is known to be still sensitive to ALS-inhibitors. Use adjuvants that optimize the activity of the alternative herbicide, even in mixtures with glyphosate.
- Ignite® or Ignite® plus either Cobra® or Flexstar® (Liberty Link® soybean only).

ALS-Resistant Common Ragweed Control in Non-GMO Soybean Fields

Rotate fields with ALS-resistant common ragweed to corn and wheat when possible. Control weeds in those crops to prevent further increases in the soil seedbank. Another useful strategy in these fields is to delay soybean planting, so that preplant tillage or burndown herbicide treatments can control a higher percentage of the total ragweed population for that season.

In fields where ALS resistance is suspected or confirmed, or in fields with a history of reliance on ALS-inhibitors for common ragweed control:

- Apply a preplant herbicide consisting of 2,4-D ester plus either glyphosate or paraquat. Preemergence soybean herbicides that contain metribuzin or Valor® (Envive®, Gangster®, Valor XLT®) can provide partial residual control of ALS-resistant plants (see table). Expect little to no residual control of common ragweed from other PRE soybean herbicides.

Product	ALS-sensitive Plants*	ALS-resistant Plants*
Authority Assist®	6	—
Authority First®/Sonic®	9	—
Canopy DF®	9	—
Envive®/Valor XLT®	9	7
Gangster®	9	7
Metribuzin®	7	7
Python®	7	—
Scepter®	8	—
Valor®	7	7

*Herbicide effectiveness ratings of 8 to 9 indicate control. Ratings of 6 or 7 indicate that the product has activity on common ragweed. More extensive ratings are available in *Weed Control Guide for Ohio and Indiana* (Purdue Extension publication WS-16, Ohio State University Extension bulletin 789).

- Apply one of the following POST treatments when common ragweed plants are no more than 4 to 6 inches tall:
  - Cobra® or Phoenix® at 12.5 oz./A, or Flexstar® at 1.0 to 1.5 pints/A. Use 1.3 to 1.5 pints/A of Flexstar® if allowed in your state. Combinations of one of these herbicides with Classic®, FirstRate®, or Synchrony® can improve control of plants that are not ALS-resistant. Do not reduce the rate of the Cobra®, Flexstar®, or Phoenix® in these combinations, or control of ALS-resistant plants will be reduced.
  - Scout fields several weeks after the first POST treatment, and make a second POST application of Cobra® or Phoenix® (as needed) to control later-emerging plants. Proper timing of this application is essential to obtain control. Apply three to four weeks after the first POST application. Do not delay application until common ragweed plants are evident above the soybean canopy or control will be reduced.

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