Identification and management of common ragweed *(Ambrosia artemisiifolia)* and giant ragweed *(Ambrosia trifida)*

Zachary Loomis, SDSU Graduate Student
Eric Jones, Assistant Professor and SDSU Extension Weed Management Specialist
Adam J. Varenhorst, Associate Professor and SDSU Extension Field Crop Entomologist

January 2025

Introduction and Importance

Common ragweed *(Ambrosia artemisiifolia)* and giant ragweed *(Ambrosia trifida)* are plant species native to North America from the Asteraceae family and are collectively referred to as "ragweed" (Figure 1). Although these plants are widely recognized because of the allergenic pollen that they produce, they are also significant agricultural pests. Both species exhibit ecological resilience and can thrive under adverse conditions such as frequently disturbed soils (i.e., crop fields, riparian areas, roadsides, and waste areas), dry/wet soils, and cool/hot temperatures (DiTomaso 2004). Although ragweed is native to North America, its biology has facilitated invasion of new regions of the continent where it was previously absent (Joly et al. 2011). Ragweed is found across the Midwest and Southern United States. Since ragweed is an early emerging weed, management tactics must be implemented immediately to ensure profitable crop production. Ragweed is believed to be one of the most common plant species in the first years of disturbed areas (Knolmajer et al. 2024).

If left non-treated, ragweed can completely outcompete all cultivated crops (Figure 2). This is because ragweed often emerges in large quantities, resulting in competition for light, water and nutrients (Pajevic et al. 2010; Qin et al. 2012; Xie et al. 2001). Additionally, ragweed lacks natural competitors in the vegetative stage allowing for successful seed production, which results in increased weed seed banks and increased ragweed pressure in subsequent growing seasons. Ragweed is primarily managed with herbicides in crop

Figure 1. Mature giant ragweed (left) and common ragweed (right) plants; side by side comparison. Left photo courtesy of Chris Evans, University of Illinois, Bugwood.org. Right photo courtesy of Barbara Tokarska-Guzik, University of Silesia, Bugwood.org.

Figure 2. Giant ragweed growing among corn. The corn adjacent to the non-treated giant ragweed patch highlights the importance of implementing effective management tactics to ensure crop protection. Photo courtesy of Eric Jones, SDSU.

production. While there are effective herbicides that can be applied pre- and postemergence to manage ragweed, there are biotypes of ragweed that are resistant to these herbicides.

Identification

Common ragweed is characterized by its fern-like leaves, green flowers, and medicinal smell (Figure 1). Seeds are dormant at maturity and require cold stratification, which is supplied by winter conditions (Pickett & Baskin 1973). Common ragweed reproduces by seeds, and flowers from July to September in most cases. At full maturity, these plants can grow up to 3.5 feet tall but are usually between one to two feet tall.

To identify common ragweed, the following characteristics can be used:

- Round, thick cotyledons (Figure 3)
- Stems covered in fine hairs
- Leaves with an opposite arrangement around the stem, typically four inches wide and six inches long
- Compound leaves, characterized by lobes and broader bases compared to the tips (Figure 4)
- Undersides of young leaves bearing hairs
- Mature leaves are mostly hairless

Figure 3. Cotyledon of common ragweed. Characterized by thick, oval shape and fleshy appearance. Photo courtesy of Ohio State Weed Lab, The Ohio State University, Bugwood.org

Figure 4. Vegetative stage of common ragweed. The plant can be identified by the finely divided leaves and dense pubescence covering the entirety of the plant. Photo courtesy of Zachary Loomis, SDSU

Giant ragweed reproduces by seed and emerges in late March and flowers from August to October. It grows much taller than common ragweed, hence the name. It generally reaches heights of 3.5 to 13 feet tall. The inflorescences, flowers, fruits, and seeds are all similar to common ragweed, although they are slightly larger. The leaves of giant ragweed are 4 to 8 inches long and mostly oppositely arranged with simple, ovate blades. The surfaces of the leaves are rough to the touch with short, dense hairs. The stems are erect and often reddish with coarse surfaces. Like common ragweed, giant ragweed has a taproot system.

To identify giant ragweed, the following characteristics can be used:

- Stems covered in fine hairs
- Thick, round cotyledons with a purple hypocotyl (Figure 5)
- Leaves with opposite arrangement around the stem, typically hairy, measuring four to eight inches wide and six inches long
- Leaves divided into three or five lobes, each with toothed edges (Figure 6)
- Green flowers, situated on small, slender stems either at the ends of branches or at the bases of upper leaves

Figure 5. Cotyledon of giant ragweed. Characterized by round, paddle-shaped leaves. Photo courtesy of Ohio State Weed Lab, The Ohio State University, Bugwood.org

Figure 6. Vegetative stage of giant ragweed. The plant can be identified by leaves divided into three to five lobes with toothed edges. Photo courtesy of Ohio State Weed Lab, The Ohio State University, Bugwood.org

Pollen Production

One of the most significant concerns associated with common ragweed is its allergenic pollen, which is released into the air during the late summer and early fall months. This pollen is a major trigger for allergenic rhinitis (hay fever) and causes conditions such as asthma, affecting millions of people worldwide (Zhao et al. 2016). A single common ragweed plant, depending on its size, can produce between 100 million and 3 billion pollen grains, with some plants releasing up to one million pollen grains per day (Fumanal et al. 2007). In one season, an acre of common ragweed can release 360 pounds of pollen (Sikoparija et al. 2009). Symptoms caused by common ragweed include a runny nose, sneezing, puffy or irritated eyes, and a stuffy or itchy nose and throat, as well as hay fever allergies (Matyasovszky et al. 2011).

Management

Five factors that are commonly cited for the increased prevalence of ragweed are:

- Early/extended germination
- Crop rotation
- Tillage
- The development of herbicide resistance
- The impact of stem-boring insects on herbicide effectiveness (Jordan et al. 2016; Johnson et al. 2012).

Cultural and mechanical tactics

No-till practices leave ragweed seeds on the soil surface, making them more susceptible to predation by insects (ground beetles, etc.), earthworms, mice, birds, or soil organisms. In contrast, conventional-till systems mix the seeds into the soil, which can prolong ragweed problems because buried seeds may escape predation and other management tactics. Additionally, due to the large seeds of ragweed, seedlings can emerge from as deep as 4 inches. While fall tillage may bury seeds below this depth, this practice ultimately extends the emergence period of some seeds as they are brought back to the surface by subsequent tillage passes (Johnson et al. 2012). A study conducted by Murphy et al. (2017) showed that narrower rows and higher corn density reduced biomass of late-emerging weeds, as well as increased corn yields by 10 to 15 percent. Inter-row cultivation did not increase yield or decrease biomass of late-emerging weeds.

Chemical

Herbicides are the main tactic to manage ragweed. Over reliance has resulted in the selection of herbicide-resistant biotypes. Giant ragweed has developed resistance to ALS-inhibitors (Group 2) and glyphosate (Group 9) and biotypes resistant to both herbicides have been confirmed (Heap 2024). Common ragweed has developed resistance to glyphosate, ALS-, PSII- (Group 5) and PPO-inhibitors (Heap 2024). Similarly, multiple herbicide-resistant biotypes have been confirmed (Heap 2024). Glyphosate-resistant common ragweed has been confirmed in South Dakota (Heap 2024).

Resistance as described above increases the difficulty of managing ragweed with herbicides. Since ragweed possesses large seeds, many preemergence herbicides are not effective. PPO-inhibitors (Group 14) and HPPD-inhibitors (Group 27) are more effective preemergence options. Preemergence ALS-inhibitors are effective as well if resistance is not present. More herbicide options are available postemergence management. Auxin type herbicides (Group 4), glufosinate (Group 10), PPO-inhibitors, and HPPD-inhibitors are effective. Since herbicide resistance is an issue in ragweed species, herbicides should be used in a manner that reduces selection pressure. Do not rely solely on one or two herbicide groups to manage ragweed. Utilizing a pre- and postemergence herbicide program and applying at least two different herbicide groups in each application will reduce selection pressure on resistant weeds and increase the spectrum of weeds managed. Crop rotation will also allow the utilization of different herbicide groups. Tables 1 and 2 provides an overview of effective herbicides to manage common and giant ragweed. Refer to the SDSU Extension Pest Management Guides for a more detailed herbicide (and pesticide) list for various crops (extension.sdstate.edu/south-dakota-pest-management-guides).

Table 1. Effective herbicide chart for chemical control of common and giant ragweed in corn.

Group	Site/MOA	Example	Application Timing
2	ALS inhibitor	flumetsulam (Python), halosulfuron (Permit)	Pre/Post
4	Growth regulator	2,4-D, dicamba (Clarity/DiFlexx), fluroxypyr (Starane), clopyralid (Stinger)	Post
5	Photosynthesis inhibitor (triazine, triazinone)	atrazine (Atrazine)	Pre/Post
6	Photosynthesis inhibitor (contact)	bentazon (Basagran), bromoxynil (Bromoxynil)	Post
9*	EPSP inhibitor	glyphosate (Roundup)	Post
10*	Glutamine synthase inhibitor	glufosinate (Liberty)	Post
14	PPO inhibitor	saflufenacil (Sharpen)	Pre
27	HPPD inhibitor	isoxaflutole (Balance Flexx), mesotrione (Callisto), topramezone (Impact/Armezon), tembotrione (Laudis)	Pre/Post
*Crop variety must be tolerant to herbicide			

Table 2. Effective herbicide chart for chemical control of common and giant ragweed in soybean.

Group	Site/MOA	Example	Application Timing
2	ALS inhibitor	chlorimuron (Classic), cloransulam (FirstRate)	Post
5	Photosynthesis inhibitor (triazine, triazinone)	metribuzin (Metribuzin)	Pre
6	Photosynthesis inhibitor (contact)	bentazon (Basagran)	Post
9*	EPSP inhibitor	glyphosate (Roundup)	Post
10*	Glutamine synthase inhibitor	glufosinate (Liberty)	Post
14	PPO inhibitor	saflufenacil (Sharpen), flumioxazin (Valor), acifluorfen (Ultra Blazer), lactofen (Cobra/Phoenix), fomesafen (Flexstar/Reflex)	Pre/Post
*Crop variety must be tolerant to herbicide			

Biological

The seeds of common ragweed are abundant in carbohydrates and are consumed by various forms of wildlife including wild turkey, sparrows, doves, mice, and squirrels. However herbivorous wildlife tends to avoid common and giant ragweed due to its bitter taste and tough seed coat preventing digestion (Missouri Department of Conservation n.d.).

There are few pollinating insects that visit the flowers of common and giant ragweed. Of these insects, some are specialized to feed exclusively on this genus. Longhorn beetles (Coleoptera: Cerambycidae) and weevils (Coleoptera: Curculionoidea) chew the leaves of common ragweed. In contrast, these insects bore into the stems of giant ragweed plants (Harrison et al. 2001). The larvae of multiple types of leaf-mining flies (Diptera: Agromyzidae) feed through the middle tissues of leaves and grasshoppers feed on the foliage of both types of ragweed. Common and giant ragweed can be inhabited by true bugs such as stink bugs, aphids, planthoppers, and treehoppers that suck the juices of the plant. There are also caterpillars that feed on ragweed. The caterpillars of Thoreau's flower moth feed on the flowers and developing flowerheads (Missouri Department of Conservation). However, these biological agents rarely cause significant reductions in ragweed biomass.

Alternative host for insect pests

While ragweed can reduce crop yield directly with competition, both ragweed and giant ragweed are hosts to stem boring insects that can cause the plants to lodge (Hodgson 1928, Decker 1930). These stem boring insects include the common stalk borer (Papaipema nebris Guenee), European corn borer (Ostrinia nubialis Hübner), and Dectes stem borer (Dectes texanus LeConte). The Dectes stem borer is also a pest of soybeans and sunflowers in South Dakota (Figure 7). Ragweed infestations could result in increased Dectes stem borer pressure for neighboring crops. European corn borer and common stalk borer are also pests of corn. The possibility for weedy hosts causing increases in pest pressure for row crops further highlights the importance of managing these weeds. In addition, research indicates that ragweed plants infested with stem-boring insects are more likely to survive glyphosate treatments (Jordan et al. 2016). Many insect-infested ragweed plants appear to have dead tissue on the upper vegetation following glyphosate application, suggesting that the application was effective. However, new growth often emerges from the lower parts of the stems, allowing the weeds to survive. It appears that stem and root-boring insects injure the vascular system of the plant, which may prevent glyphosate from properly translocating and killing the plant.

Figure 7. Dectes stem borer adult. Photo courtesy David Cappaert, Bugwood.org

Conclusion

Ragweed can significantly reduce crop yield and adversely affect human health (pollen) if not effectively managed. Proper identification of these weeds can ensure that the correct management tactic is implemented. Their aggressive growth patterns and adaptability make them persistent weeds in various environments and effective management is crucial to mitigating their impact. Understanding the characteristics and behavior of these species is essential for reducing their risks in agriculture. Effective management of these weed species should utilize biological, cultural, mechanical and chemical tactics.

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