

# Waterhemp Management in Soybeans



## Waterhemp Biology

- Waterhemp emerges throughout the growing season, and a higher percentage of plants can emerge later in the season than is typical with most summer annual weeds. This emergence pattern allows waterhemp to avoid many preemergence herbicides and to flourish after postemergence applications of non-residual herbicides.
- Waterhemp grows more rapidly than most weeds or crops — typically about 1 to 1 ¼ inches per day during the growing season. This allows waterhemp seedlings to acquire more sunlight.
- Waterhemp is a prolific seed producer and able to produce 1.5 times more seed than most pigweed species. Plants generally produce about 250,000 seeds per plant, although some can produce as many as 1,000,000 or more when growing under optimal conditions in noncompetitive environments.
- The seeds are small (about the size of dull pencil tip) and can easily be transported by waterfowl and contaminated farm equipment or fertilizer.
- Only 1% to 12% of waterhemp seeds remain viable in the soil seedbank after four years.
- Waterhemp gains a competitive advantage over several aggressive summer annual weeds through the sheer number of plants that can infest an area. Season-long competition by waterhemp (more than 20 plants per square foot) has been shown to reduce soybean yield by 44%. Waterhemp that emerged as late as V5 soybeans reduced yields up to 10%.



Waterhemp seeds are tiny and travel easily via humans, machinery and Mother Nature. (Photo credit: Erin Hill, Michigan State University)



Young waterhemp plant. Note how much longer the leaf length is than the petiole length. (Photo credit: Claudio Rubione, GROW)

## Genetic Diversity and Herbicide Resistance in Waterhemp

- The dioecious nature of waterhemp (male and female flowers on separate plants) means the genetic diversity within a waterhemp population tends to be greater than most agronomic weeds. This genetic diversity increases potential for the evolution and spread of herbicide-resistance genes and other traits that improve waterhemp survival in agronomic systems.
- Waterhemp has a remarkable ability to adapt to control tactics and has evolved resistance to herbicides from many different classes. Waterhemp populations with resistance to eight herbicide groups have been documented to date. The herbicides include: Group 2, ALS inhibitors (Pursuit, Classic); Group 4, plant growth regulators (2,4-D, dicamba); Group 5, photosystem II inhibitors (atrazine); Group 9 (glyphosate); Group 10 (glufosinate); Group 14, PPO inhibitors (Cobra, Flexstar); and Group 27 HPPD-inhibitors (Callisto, Laudis).
- Many populations now exhibit multiple herbicide-resistance traits that include herbicides from several families. For example, waterhemp resistance to Groups 2 and 9 (ALS-inhibitors and glyphosate) is fairly common among U.S. populations, and in many states, resistance to herbicides from as many as three, four or five groups now occurs. In 2017, a population with resistance to herbicides from six common herbicide groups was confirmed. It should be noted that Group 14 (PPO-inhibitor) herbicides with residual activity can be expected to control waterhemp when applied preemergence, even in populations with documented resistance to postemergence applications of PPO-inhibiting herbicides. However, the length of the residual activity will likely be shorter.

## Management of Herbicide-Resistant Waterhemp in Soybeans

### Integrated Weed Management

Given the extent of herbicide-resistant waterhemp populations, integrating multiple cultural or mechanical tactics with herbicide programs that include multiple effective sites-of-action will be the most effective strategies to control this weed moving forward. Non-chemical weed control tactics such as the following, should be considered:

- Fall-seeded cover crops, such as cereal rye, can reduce early-season waterhemp emergence. Delaying cereal rye termination until soybean planting, often called “planting green,” can provide up to a 50% reduction in waterhemp emergence when cereal rye biomass exceeds 4,000 lb/ac.
- Narrow row spacing (15 inches or less) combined with timely planting into fit soils increases the likelihood of fast-emerging, even soybean stands that canopy earlier and outcompete waterhemp. When coupled with effective herbicide programs, narrow row spacing can reduce waterhemp seed production by up to 25% due to faster canopy closure.
- Harvest weed seed control strategies such as chaff-lining, which concentrates weed seed contained in chaff within narrow rows, can confine the spread of waterhemp seed that is left on the plant at harvest (~70%) and reduce emergence the following year.
- Deep tillage (i.e. moldboard plowing) reduces the amount of waterhemp seed that germinates by burying seed at unfavorable depths. Combining this kind of tillage with residual herbicides has been shown to reduce emergence of pigweeds, including waterhemp, by 97%.

### Chemical Control

1. Soon before or after planting, apply a full labeled rate of two or more effective preemergence residual herbicides a few days before soybean planting or before emergence.

- Why invest in a soil-residual herbicide? Over-reliance on postemergence herbicides has contributed substantially to waterhemp developing herbicide resistance. The application of an effective, soil-applied residual herbicide introduces an effective herbicide group to the control program, reduces the number and size of weeds that must be controlled by postemergence herbicide applications, and delays emergence of waterhemp, which protects soybean yield potential from early-season interference.

- Why use a full rate instead of a reduced (“setup”) rate? Waterhemp emergence extends late into the growing season. The later that waterhemp emergence can be delayed, the greater the potential to achieve maximum or near-maximum soybean yield and improve the success of postemergence herbicide treatments. Reduced rates are likely to reduce the percentage of waterhemp population that will be controlled by the postemergence products. Full rates are also more likely to delay the onset of herbicide resistance when compared to reduced rates.



Severe waterhemp infestation. (Photo credit: United Soybean Board)

2. Apply an effective postemergence herbicide with an overlapping residual herbicide. In **conventional or glyphosate-resistant soybeans**:

- If Group 9 (glyphosate) resistance is known or suspected, and there is no reason to believe the population is also resistant to Group 14 (PPO inhibitor) herbicides, apply a Group 14 herbicide such as Cobra, Flexstar, or Ultra Blazer to waterhemp not more than 3 to 4 inches in height.
- In glyphosate-resistant soybeans, glyphosate can be applied in combination with a Group 14 herbicide, depending on the spectrum of other weeds present. The size of the waterhemp at application greatly impacts the level of waterhemp control achieved. Group 14 herbicides are most effective against waterhemp under 4 inches tall.





Waterhemp escape in soybeans. (Photo credit: Rodrigo Werle, University of Wisconsin-Madison)

- To ensure thorough spray coverage, Group 14 herbicides such as Flexstar and Cobra should be applied in a minimum of 15 gallons of water per acre. In dense weed/crop canopies, 25 gallons of water per acre should be used. If Prefix has been applied preemergence, do not apply Flexstar or any fomesafen product postemergence due to label restrictions.
- If Group 14 resistance is also known or suspected, the only additional options for waterhemp control after soybean emergence include: 1) applying an overlapping residual herbicide prior to emergence of any subsequent waterhemp germination, 2) inter-row cultivation or 3) hand removal.
- Regardless of the herbicide resistance traits in waterhemp, the addition of an effective overlapping residual herbicide to the postemergence herbicide is likely to reduce waterhemp emergence for the remainder of the season. Effective overlapping residual herbicides include but are not limited to Group 15 herbicides such as Anthem Maxx, Dual II Magnum, Outlook, Perpetuo, Prefix, Warrant and Zidua.

**In glufosinate-resistant soybeans** (Enlist E3, LibertyLink or XtendFlex): Remember that it is critical to apply an effective preemergence soil-residual herbicide as outlined in Step 1. Then, apply glufosinate (such as Liberty, Liberty Ultra, Interline and others) to waterhemp not more than 3 to 4 inches in height.

- Waterhemp should be no more than 3 to 4 inches tall at the time of application. Control will decrease as weeds get larger.
- Glufosinate should be applied in a minimum of 15 gallons of water per acre, with 1.5 to 3 pounds per acre of spray grade ammonium sulfate (AMS). In dense weed/crop canopies, 25 gallons of water per acre should be used to ensure thorough spray coverage.
- Apply glufosinate using nozzles and pressures that generate medium (250 to 350 micron) spray droplets. Do not use nozzles that produce ultra-coarse, extremely coarse or very coarse sprays.

- The addition of an overlapping residual herbicide to the postemergence glufosinate treatment is likely to reduce or eliminate waterhemp emergence for the remainder of the season. Effective overlapping residual herbicides include but are not limited to Group 15 herbicides such as Anthem Maxx, Dual II Magnum, Outlook, Perpetuo, Prefix, Warrant and Zidua.

**In dicamba-resistant soybeans** (Roundup Ready 2 Xtend or XtendFlex): Remember that it is critical to apply an effective preemergence soil-residual herbicide as outlined in Step 1. Then, apply one of the approved dicamba products (Stryax, Engenia, Tavium) to waterhemp not more than 3 to 4 inches in height. The current labels for these herbicides will expire and products should not be used after February 6, 2028.

- Prior to applying any approved dicamba product, all applicators must complete a dicamba-specific training provided by the registrant of the product or by a state-authorized provider.
- These dicamba products must be applied with both a label-compliant drift reduction adjuvant (DRA) and volatility reduction agent (VRA). They should not be applied with ammonium sulfate. Check product labels and websites for full requirements, including spray drift and runoff mitigation and other Endangered Species Act requirements.
- The addition of an overlapping residual herbicide to the postemergence dicamba treatment is likely to reduce waterhemp emergence for the remainder of the season. Effective overlapping residual herbicides include but are not limited to Group 15 herbicides such as Anthem Maxx, Dual II Magnum, Outlook, Perpetuo, Prefix, Warrant and Zidua.
- The waterhemp size at the time of application will be an important factor in determining the level of waterhemp control achieved.

**In 2,4-D-resistant soybeans (Enlist E3):** Remember that it is critical to apply an effective preemergence soil-residual herbicide as outlined in Step 1.

- The waterhemp size at the time of application will be an important factor in determining the level of waterhemp control achieved.
- Postemergence applications of Enlist One (2,4-D choline) plus Liberty offer two effective sites of action on glyphosate-resistant broadleaf weed species such as waterhemp.
- The only approved 2,4-D choline product (Enlist One) can only be applied using approved nozzles and with approved tank-mix partners, drift reduction agents and downwind buffers. Consult the product label for specific requirements.
- The addition of an overlapping residual herbicide to the postemergence Enlist herbicide treatment is likely to reduce or eliminate waterhemp emergence for the remainder of the season. Effective overlapping residual herbicides include but are not limited to Group 15 herbicides such as Anthem Maxx, Dual II Magnum, Outlook, Perpetuo, Prefix, Warrant and Zidua.

3. Scout the field within seven to 14 days after the initial postemergence application to determine treatment effectiveness. If waterhemp escapes control, take precautions to prevent its spread. Pulling and removing mature plants will prevent additional seeds entering the soil seedbank. Cleaning equipment, particularly combines, before moving to non-infested parts of the field or to different fields, will also reduce the spread of seeds.



If all other control tactics have failed, hand removal of waterhemp may be necessary to prevent seeds from entering the soil seedbank of your field. (Photo credit: United Soybean Board)

**For more information and links to additional resources visit [growiwm.org/take-action-home/](https://growiwm.org/take-action-home/).**

Technical editing for this publication was led by Kevin Bradley (University of Missouri) and Mandy Bish (University of Missouri) in 2020. This publication was updated in 2026 by Sarah Ganske (Kansas State University), Michael Flessner (Virginia Tech), John Wallace (Penn State University), Mark VanGessel (University of Delaware), and Christy Sprague (Michigan State University). The United Soybean Board neither recommends nor discourages the implementation of any advice contained herein, and are not liable for the use or misuse of the information provided. ©2026 United Soybean Board. 59783 07/2026

Brought to you by the Soy Checkoff.

