Waterhemp Management in Soybeans

Waterhemp Biology

- Waterhemp gains a competitive advantage over several more 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 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.
- This species emerges throughout the growing season, and a higher percentage of plants can emerge later in the season than is typical with most other summer annual weeds. This emergence pattern allows waterhemp to avoid many preemergence herbicides and to often flourish after post-emergence applications of non-residual herbicides such as glyphosate.
- Waterhemp is a prolific seed producer and able to produce 1.5 times more seed than most other 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 (approximately 3 millimeters in length) and can easily be transported by contaminated machinery, by waterfowl, through the spread of poultry litter as fertilizer, etc.
- Like most weeds, waterhemp seeds remain viable in the soil for several years. Research has shown that only 1% to 12% of waterhemp seeds remain viable in the soil seedbank after four years.

A waterhemp seedling emerges. Notice the egg-shaped cotyledons. This species can emerge throughout the growing season and make waterhemp difficult to manage.

Genetic Diversity and Herbicide Resistance in Waterhemp

- Waterhemp is dioecious (male and female flowers on separate plants), and must outcross. Therefore, the genetic diversity within a population tends to be greater than for most agronomic weeds. This genetic diversity increases potential for the evolution and spread of novel 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. To date, waterhemp has evolved resistance to herbicides from seven classes, including Group 5 (e.g., triazines such as atrazine and simazine); Group 2 (e.g., ALS-inhibiting herbicides such as Pursuit® and Classic®); Group 15 (e.g., fatty acid inhibitors such as metolachlor); Group 14 (e.g., PPO-inhibiting herbicides such as Ultra Blazer®, Cobra® and Flexstar®); Group 9 (e.g., glyphosate); Group 27 (e.g., HPPD-inhibiting herbicides such as Callisto®, Laudis® and Impact®); and Group 4 (e.g., 2,4-D).
- Many populations in the Midwest now exhibit multiple herbicide resistances that include herbicides from several families. For example, Groups 2 and 9 (e.g., ALS-inhibiting herbicides and glyphosate) resistance in waterhemp is fairly common, 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 commonly used herbicide groups was confirmed. It should be noted that Group 14 PPO-inhibitor herbicides with residual activity are likely to have utility in controlling PPO-resistant waterhemp when applied preemergence.

Management of Herbicide-Resistant Waterhemp in Soybeans

The focus of this section is predominantly chemical control. However, given the extent of herbicide-resistant waterhemp populations, cultural and mechanical options, such as the following, should be considered:

- Narrow row spacing and optimum soybean planting populations increase the crop's ability to outcompete waterhemp for nutrients and resources.
- Deep tillage reduces the amount of waterhemp seed that germinates by burying seed at unfavorable depths. A program consisting of deep tillage in combination with residual herbicides has been shown to reduce emergence of pigweeds, including waterhemp, by 97%.

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- Fall-seeded cover crops, such as cereal rye, can reduce early-season waterhemp emergence in the spring.

The most effective strategies to reduce herbicide-resistant waterhemp populations will integrate cultural and mechanical techniques with chemical control.

Chemical Control

1. Soon before or after soybean planting, apply a full rate (according to label guidelines for soil type and organic matter content) of an ***effective*** preemergence, soil-residual herbicide.
   - **Why invest in a soil-residual herbicide?** Over-reliance on post-emergent herbicides has contributed substantially to waterhemp developing herbicide resistance. Application of an effective, soil-applied residual herbicide introduces an effective herbicide group to the control program 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 post-emergence herbicide treatments. Reduced rates are likely to reduce the percentage of waterhemp population that will be controlled by the post-emergent products. Full rates are also more likely to delay the onset of herbicide resistance when compared to reduced rates.
   - Depending on the herbicide-resistance profile, effective soil-residual herbicides may include: Authority® First, Authority Assist, Authority MTZ, Authority XL, Boundary®, Dual II Magnum (or other metolachlor products), Enlite®, Envive®, Fierce®, Outlook®, Prefix®, Sencor®, Sonic®, Treflan®, Trivence®, Valor®, Valor XLT, Warrant® and Zidua.
2. Apply an effective post-emergence herbicide with an overlapping residual herbicide.
   a. **In conventional or glyphosate-tolerant soybeans:** If Group 9 (e.g., glyphosate) resistance is known or suspected and there is no reason to believe the population is also resistant to Group 14 (e.g., PPO inhibitors) herbicides, apply a Group 14 herbicide such as Cobra, Flexstar or Ultra Blazer to waterhemp not more than 3-4 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 is a critical determinant of the level of waterhemp control achieved. Group 14 herbicides are most effective against waterhemp 4 inches or less in height.
   - 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, 20 to 40 gallons of water per acre should be used.
   - If Prefix has been applied preemergence, do not apply Flexstar or any fomesafen product post-emergence due to label restrictions.
   - **If Group 14 resistance is also known or suspected,** the only additional options for waterhemp control include: 1) applying an overlapping residual herbicide prior to emergence of any subsequent waterhemp germination, 2) inter-row cultivation or 3) hand roguing.
   - Regardless of the herbicide resistances in waterhemp, the addition of an effective overlapping residual herbicide to the post-emergence herbicide 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, Cinch®, Dual II Magnum, Outlook, Prefix, Warrant and Zidua.

   b. **In glufosinate-tolerant soybeans (Enlist E3®, LibertyLink or LibertyLink GT27):** Remember that it is critical to apply an effective preemergence soil-residual herbicide as outlined in Step 1. Then, apply glufosinate (Group 10 herbicide) to waterhemp not more than 3 to 4 inches in height.
   - The waterhemp size at application will be an important determining factor in the level of waterhemp control achieved.
   - Glufosinate should be applied in a minimum of 15 gallons of water per acre. In dense weed/crop canopies, 20 to 40 gallons of water per acre should be used to ensure thorough spray coverage.
   - Apply glufosinate using nozzles and pressures that generate medium (250-350 micron) spray droplets. Do not use nozzles that produce ultra-coarse,

Waterhemp seed are ~3 millimeters long, which is much smaller than other plant seed like corn. The small size allows waterhemp seed to go unnoticed and be easily transported between fields.

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extremely coarse or very coarse sprays.

- The addition of an overlapping residual herbicide to the post-emergence 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, Cinch, Dual II Magnum, Outlook, Prefix, Warrant and Zidua.

c. **In dicamba-resistant soybeans (Roundup Ready 2 Xtend®):** 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 (Engenia®, FeXapan®, Tavium®, XtendiMax® with VaporGrip) to waterhemp not more than 3 to 4 inches in height. Currently, if Xtend soybeans are used, the dicamba formulations of XtendiMax, FeXapan or Engenia may be applied as the post-emergence herbicide option if farmers or commercial applicators have existing stocks and the herbicides are applied prior to individual state label cutoffs or July 31, 2020, whichever is more restrictive.

- Prior to applying any approved dicamba product, all applicators must complete a dicamba-specific training provided by the registrant of the product being applied or by a state-authorized provider. The Environmental Protection Agency is currently reviewing new registrations for dicamba-containing herbicides for 2021 and beyond. The 2018 labels are to be followed for Engenia, XtendiMax and FeXapan applications made through July 31, 2020.
- The waterhemp size at the time of application will be an important factor in determining the level of waterhemp control achieved.
- These dicamba products can only be applied using approved nozzles that generate coarse or ultra-coarse spray droplets and with approved tank-mix partners, drift reduction agents and downwind buffers. Consult individual product labels for specific requirements.
- The addition of an overlapping residual herbicide to the post-emergence dicamba 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, Cinch, Dual II Magnum, Outlook, Prefix, Warrant and Zidua.

d. **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.
- Post-emergence 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.
- Enlist Duo® (glyphosate + 2,4-D choline) is another approved post-emergence herbicide option for use on Enlist E3 soybeans on glyphosate-resistant waterhemp.
- The only approved 2,4-D choline products (Enlist One and Enlist Duo) can only be applied using approved nozzles and with approved tank-mix partners, drift reduction agents and downwind buffers. Consult individual product labels for specific requirements.
- The addition of an overlapping residual herbicide to the post-emergence Enlist® herbicide treatment vs. 2,4-D 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, Cinch, Dual II Magnum, Outlook, Prefix, Warrant and Zidua.

3. Scout the field within seven to 14 days after the initial post-emergence application to determine treatment effectiveness. If there are still surviving plants present, rogue these plants from the field **before** they reach a reproductive growth stage.

Waterhemp plants are male or female and require outcrossing to produce seed. Outcrossing increases the likelihood of plants developing herbicide resistance. Male plants shed pollen as indicated by the red arrow in this image. Female plants within the field and in surrounding areas should not be allowed to reproduce.

For more information and links to additional resources, visit ***www.IWillTakeAction.com****.*

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