



## WATERHEMP MANAGEMENT

### What You'll Learn...

- Waterhemp has become one of the most troublesome weeds in many agricultural regions in the United States.
- Waterhemp is a prolific seed producer that can produce 300,000 or more seeds/plant.
- Control of waterhemp may require multiple herbicide applications as some populations may be resistance to multiple herbicide groups making effective weed management difficult.

### Waterhemp Biology

Common (*Amaranthus rudis*) and tall (*Amaranthus tuberculatus*) waterhemp are native species adapted to various conditions across the United States. Waterhemp's native habitat is wet, low-lying areas, but it has also adapted to reduced and no-till conditions. Waterhemp can be distinguished by the glossy, long, hairless, narrow leaves and stems (Figure 1). Waterhemp species are dioecious, meaning male and female flowers are on separate plants, and two plants always mix genes during reproduction. This increases diversity within populations and the potential to spread resistance and other survival genes. Pollen can move up to 1/2 mile during windy conditions.<sup>1</sup>

Waterhemp plants emerge continuously and late into the season. They are prolific seed producers and can produce 300,000 or more seeds/plant.<sup>2</sup> Seeds are small, but can survive in the soil for several years. The extended emergence pattern and prolific seed production may require multiple herbicide applications in cropping systems. Production practices that can enhance crop competitiveness and disrupt waterhemp seed production are extremely valuable tools for waterhemp management (Table 1).

Waterhemp has a relatively higher growth rate than most weeds or crops at an upwards of one inch/day during the season.<sup>3</sup> Competition resulted in a 44% reduction in yield in 30-inch and 37% in 7.5-inch row soybean.<sup>5</sup> Corn yield was reduced 15%. Delaying weed emergence in soybean beyond V5 resulted in a 10% yield reduction or 1% reduction in corn when waterhemp was controlled prior to 6 inches in height.<sup>5</sup>

### Herbicide Management

Most research studies have found that crop yield potential is protected if weeds are controlled before they reach a height of 4 to 5 inches in corn or soybean.<sup>6</sup> Preplant/preemergence (PRE), residual herbicides are the foundation for waterhemp control in corn and soybean. Soil-applied PRE herbicides represent the best chemical option for control of waterhemp biotypes resistant to glyphosate, ALS, PPO, and HPPD inhibitor herbicides. A PRE herbicide application helps reduce early-



Figure 1. Waterhemp seedlings (left) and flowers (right).

season weed competition, adds additional sites of action to a weed management program, and expands the postemergence (POST) application window. There are several herbicides with alternative sites of action for use in soybean and corn (Table 2). Sequential applications of herbicides with different sites of action and tank mixtures are the best options for waterhemp management. To maximize the effectiveness of soil-applied PRE herbicides, consider these tips to improve performance:

1. Waterhemp present at burndown - tankmix dicamba or 2,4-D with Roundup WeatherMAX® or Roundup PowerMAX® herbicides, but be sure to consult product labels for planting interval restrictions.
2. Select the PRE herbicides based on the weed spectrum in each field.
3. Use full labeled rates of PRE herbicides.
4. Consult each product label to identify precautions and restrictions for premix products that have chlorimuron (Rowel™ FX Herbicide, Valor® XLT, Authority® XL) or metribuzin (Authority® MTZ) as an active ingredient.
5. Scout each field regularly to determine in-crop application timing and to identify waterhemp that may have escaped the previous application or emerged late.

Continuous emergence of waterhemp normally requires the use of POST herbicide applications even following PRE herbicide applications. Waterhemp should be sprayed when actively growing and at or before 4 inches in height. Thorough

**Table 1. Effect of waterhemp emergence time on growth and seed production in soybean at Story, IA.<sup>4</sup>**

Waterhemp emergence date based on soybean stage of growth	Waterhemp survival %	Waterhemp seed production (1,000s)	Soybean yield reduction %
At planting	90	2,500	42
V2	85	1,600	24
V4	72	490	6
V6	27	250	2



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spray coverage is essential, particularly when tank-mixing other herbicides with Roundup WeatherMAX® or Roundup PowerMAX® herbicides.

### Managing Glyphosate-resistant Biotypes

Dicamba and 2,4-D can be tank-mixed with Roundup WeatherMAX® or Roundup PowerMAX® herbicides for burndown applications. Use a PRE herbicide, premixture, or tank mixture at planting. Warrant® and Warrant® Ultra Herbicide\* products have residual activity and the optimal timing of application is PRE or when soybeans are V2-V3 growth stage. TripleFLEX® II Herbicide has residual activity and should be applied before waterhemp emerges and before corn is 11 inches tall. There are a number of PRE and POST herbicide options to compliment or tankmix with Roundup WeatherMAX® or Roundup PowerMAX® herbicides (Table 3).

**Table 2. Herbicide groups\* for managing waterhemp in soybean and corn.**

Soybean - PRE	Soybean - POST
Acetamide (15) - acetochlor, S-metolachlor, dimethenamid-P Pyrazole (15) - pyroxasulfone	Diphenylether (14) - acifluorfen, fomesafen, lactofen
Dinitroaniline (3) - pendimethalin, trifluralin	Glycine (9) - glyphosate**
N-phenylphthalimide (14) - flumioxazin Aryl triazinone (14) - sulfentrazone Pyrimidinedione (14) - saflufenacil	Phosphinic acid (10) - glufosinate***
Triazone (5) - metribuzin	
Corn - PRE	Corn - POST
Acetamide (15) - acetochlor, metolachlor, dimethenamid Pyrazole (15) - pyroxasulfone	Triazine (5) - atrazine
Triazine (5) - atrazine, simazine	Phenoxy (4) - 2,4-D Benzoic acid (4) - dicamba
Isoxazole (27) - isoxaflutole Triketone (27) - mesotrione	Pyrazolone (27) - topramezone, pyrasulfatole Triketone (27) - mesotrione, tembotrione
	Glycine (9) - glyphosate**
	Phosphinic acid (10) - glufosinate***

\* Waterhemp herbicide resistant biotypes have been identified for Herbicide Groups 2, 4, 5, 9, 14, and 27. Consult local University reports to determine if one or more of these biotypes are in a production area.

\*\* Only for Genuity® Roundup Ready 2 Yield® and Roundup Ready® Soybeans and Roundup Ready® Corn 2, corn with Roundup Ready® 2 Technology.

\*\*\* Only for soybean and corn products with the LibertyLink® trait.

**Table 3. Monsanto recommended herbicides for waterhemp.**

#### PRE - Roundup Ready®, Genuity® Roundup Ready 2 Yield® Soybean

Rowel™ Herbicide, Rowel™ FX Herbicide, Warrant® Herbicide, Warrant® Ultra Herbicide\*, Fierce®, Fierce® XLT, Valor®, Valor® XLT, Gangster®, Authority® Assist, Authority® First, Authority® MTZ, Authority® XL, or Authority® Maxx

#### POST - Roundup Ready®, Genuity® Roundup Ready 2 Yield® Soybean

Roundup WeatherMAX® or Roundup PowerMAX® tank-mixed with Warrant® Herbicide, Warrant® Ultra Herbicide\*, Cobra® or fomesafen

#### PRE - Roundup Ready® Corn 2, corn with Roundup Ready® 2 Technology

Harness® Brands, Degree Xtra®, TripleFLEX® II Herbicide

#### POST - Roundup Ready® Corn 2, corn with Roundup Ready® 2 Technology

Roundup WeatherMAX® or Roundup PowerMAX® tank-mixed with IMPACT®, Status®, Clarity® or 2,4-D

Sources: <sup>1</sup> Costea, M., Weaver, S.E., and Tardif, F.J. 2005. The biology of invasive alien plants in Canada. 3. *Amaranthus tuberculatus* (Moq.) Sauer var. *rudis* (Sauer). Can. J. Plant Sci. 85:507-522. <sup>2</sup> Sellers, B.A., Smeda, R.J., Johnson, W.G., Kendig, J.A., and Ellersieck, M.R. 2003. Comparative growth of six *Amaranthus* species in Missouri. Weed Sci. 51:329-333. <sup>3</sup> Seibert, A. C. and Pearce, R.B. 1993. Growth analysis of weed and crop species with reference to seed weight. Weed Sci. 41:52-56. <sup>4</sup> Hartzler, B. and Battles, B. 1998. Late-emerging waterhemp - how big of a problem? Iowa State Weed Science online. <sup>5</sup> Nordby, D., Hartzler, B., and Bradley, K. 2007. Biology and management of waterhemp. GWC-13. <sup>6</sup> Hartzler, R. 2000. Early season weed competition. Iowa State University Integrated Crop Management.

\*Please see Regional Map within the Warrant® Ultra Herbicide label for specific states where this product is anticipated to be registered for the 2016 season. As of July 23, 2015, approval for sales and distribution has not been received for: Connecticut and Massachusetts. All other states represented on the Area maps are approved for sales and distribution as of July 23, 2015.

**THIS DOCUMENT IS INTENDED TO PROVIDE INFORMATION ABOUT THIS WEED AND GUIDELINES FOR CONTROL. AS A TOUGH-TO-CONTROL WEED, KNOWLEDGE ABOUT THE BIOLOGY AND WEED CONTROL PROGRAMS WILL HELP IN THEIR MANAGEMENT.**

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