ROUNDUP READY PLUS
CROP MANAGEMENT SOLUTIONS

PALMER AMARANTH - A WEED TO WATCH

What You'll Learn...

- Palmer amaranth is an aggressive weed that can spread quickly and has evolved resistance to multiple herbicide sites of action.
- Field scouting and early identification are important to prevent weed seed production and spread..
- Distinguishing Palmer amaranth from other pigweed species can be difficult. Petiole length and appearance of the inflorescence are key differentiating characteristics.
- Weed management strategies should include overlapping residual herbicides and multiple herbicide applications with unique sites of action.

Palmer amaranth is native to the desert southwest of the United States. Palmer amaranth has a high degree of genetic and phenotypic variability, allowing it to adapt to diverse climatic and agricultural conditions throughout much of the eastern half of the United States. Expansion into the northern Corn Belt has heightened the need to identify new infestations and implement integrated weed management tactics to limit the spread by Palmer amaranth.

Competitive Advantage

It is important to correctly distinguish Palmer amaranth from other Amaranthus species as it is aggressive, competitive, and has many characteristics common to plants that are prone to develop herbicide resistance. Palmer amaranth can reduce yield potential of up to 91% in corn and 78% in soybeans.[1]

Characteristics that give Palmer amaranth a competitive advantage include:

- Palmer amaranth and waterhemp (common and tall) have separate male and female plants (dioecious, Figure 1). This gives them the ability to cross pollinate, which can increase genetic diversity within a species. Palmer amaranth can readily hybridize with waterhemp and monoecious pigweeds such as redroot and smooth pigweed.
- Palmer amaranth has a rapid growth rate and produces a large amount of biomass. The photosynthetic rate of Palmer amaranth is three to four times that of corn, cotton, and soybean.[2] It produces about twice the biomass and height of waterhemp.[7] Consequently, there is a narrow application window for early post-emergence herbicide applications before Palmer amaranth begins rapid growth and becomes more difficult to control.[9]

Figure 1. Palmer amaranth is dioecious with separate male (left) and female (right) plants. Photo on right is courtesy of Dr. Dallas Peterson, Kansas State University, Agricultural Experiment Station and Cooperative Extension Service.

- Palmer amaranth is a prolific seed producer. A single female plant has the ability to produce 500,000 to 1 million seeds which germinate at a higher rate than many other Amaranthus species.[1,2] These seeds are small and easily mobile, contributing to the spread of this weed. However, Palmer amaranth seeds are relatively short-lived in the soil, with about 80% mortality in three years.[4]

All of these characteristics give Palmer amaranth a heightened ability to develop resistance to herbicides. Populations of Palmer amaranth have been identified as resistant to Group 2 ALS inhibitors (chlorimuron), Group 3 dinitroanilines (trifluralin), Group 5 photosystem II inhibitors (atrazine), Group 9 glycine (glyphosate), and Group 27 HPPD inhibitors (mesotrione).[5,8] Glyphosate-resistant Palmer amaranth is widespread throughout the southern United States and spreading into many northern states (Figure 3).[10] A population in Kansas has been documented to be resistant to Group 3, 5, and 27 herbicides.[7]

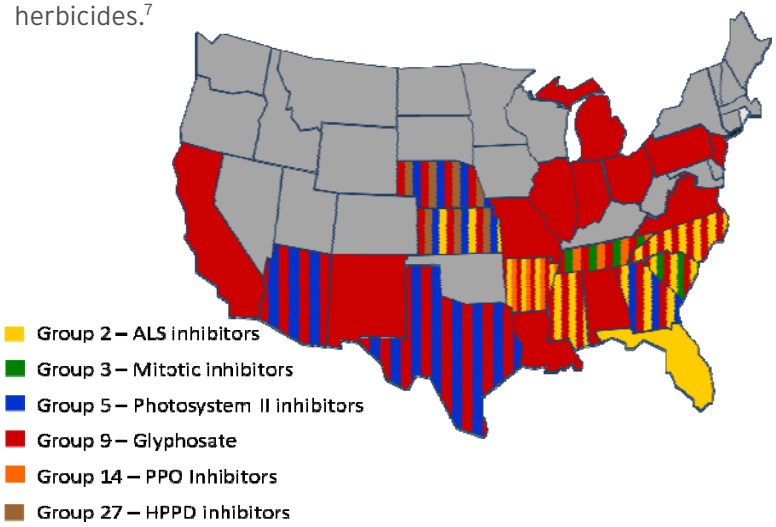

Figure 3. Distribution of herbicide resistant populations of Palmer amaranth in 2015.[8,9]

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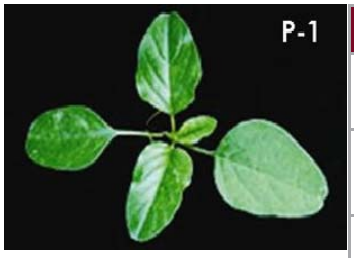
Figure 2. Identifying characteristics of Palmer amaranth and waterhemp in the seedling stage.[6]



Characteristic	Palmer amaranth	Waterhemp
Pubescence (hair)	None or rare (P-1 and P-2)	None or rare (W-1 and W-2)
Leaf Surface	Smooth (P-1). Hair in notch of leaf tip	Smooth, waxy surface (W-1 and W-2)
Petiole Length	Longer than leaf blade (P-2 and P-3)	Shorter than leaf blade (W-1 and W-2)
Inflorescence and Flowering Structures	1 to 2 feet long, thick, and minimal branching. Long, stiff, sharp flower bracts (Figure 1)	Open and near the top of plant and tips of branches. Color and length can vary greatly (W-3)
Other Identifying Characteristics	V-shaped leaf variegation is common, but not always present (P-3)	Leaf shape is variable, but often longer and more slender (W-2)
Other Identifying Characteristics	Symmetrical leaf arrangement with poinsettia appearance (P-3)	Leaves form a less patterned rosette appearance when observed from above.

Figures P-1 to P-3. Palmer amaranth seedling and vegetative growth stages.
Figures W-1 to W-3. Waterhemp from seedling stage through reproductive maturity.
Photos courtesy of Kansas State University Agricultural Experiment Station and Cooperative Extension Service.

Summary

Aggressive tactics are needed to effectively manage Palmer amaranth. Scout frequently to identify plants early to prevent establishment (Figure 2). Refer to the publication **Managing Palmer Amaranth** for northern or southern regions and work with your local representative to develop management tactics for Palmer amaranth.

Special management considerations should be made for Palmer Pigweed resistant to glyphosate and POST applied PPO inhibitors. Please work with your seed brand representative to determine the appropriate management strategy for your field.

Sources:
[1] Smith, P. 2011.The truth about pigweed. AgWeb.
[2] Steckel, L. 2007. The dioecious Amaranthus spp.: Here to stay. Weed Technology 21: 567-570.
[3] Horak, M.J. and Loughin, T.M. 2000. Growth analysis of four Amaranthus species. Weed Science 48: 347-355.
[4] Sosnoskie, L.M., Webster, T.M., Culpepper, and A.S., Kichler, J. The biology and ecology of Palmer amaranth: Implications for control. University of Georgia Extension.
[5] Heap, I. The International Survey of Herbicide Resistant Weeds.
[6] Horak, M.J., Peterson, D.E., Chessman, D.J. and Wax, L.M.1994. Pigweed identification: a pictorial guide to the common pigweeds of the great plains. S-80. Kansas State University, Agricultural Experiment Station and Cooperative Extension Service.
[7] Hartzler, B. 2013. Palmer amaranth: ID, biology and management. Integrated crop management Conference. Iowa State University.
[8] Bradley, K. 2014. Herbicide resistance in Palmer amaranth 2013. University of Missouri.
[9] Hager, A. 2014. Visualaizing the growth rate of Palmer amaranth. The Bulletin. University of Illinois.
[10] Kruger, G., Vieira, B.C., Samuelson, S., and Jhala, A. 2015. Glyphosate-resistant Palmer Amaranth confirmed in southwest Nebraska. University of Nebraska CropWatch.

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. For additional information, contact your local seed representative.
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