# CROP FOCUS

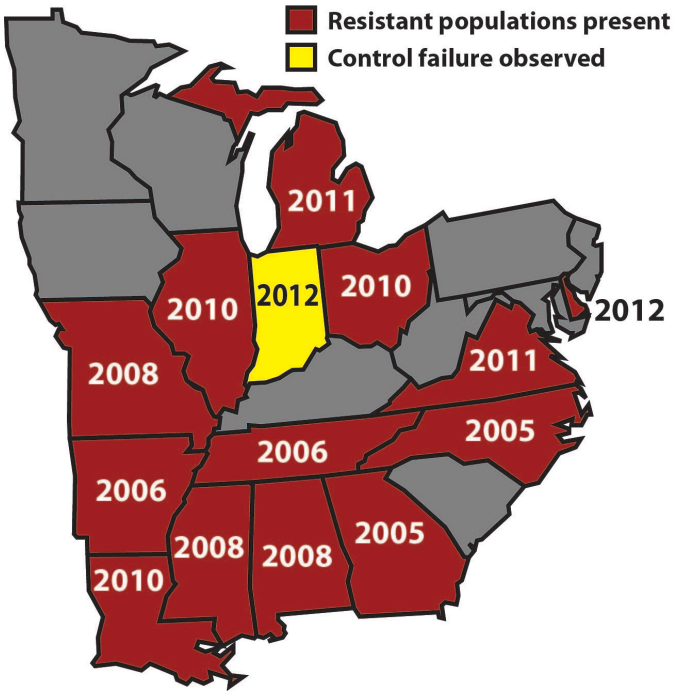
DUPONT PIONEER

## *Palmer Amaranth in the North Central U.S.*

## Palmer amaranth: A growing problem

- Palmer amaranth has traditionally been a problematic weed in the southeastern U.S., with the spread of glyphosate-resistant populations over the past several years creating severe management challenges.
- Recently, Palmer amaranth has been becoming a greater problem in Midwestern crop production.
  - Palmer amaranth appears to be extending its range northward, much as waterhemp did in the 1990's.
  - Populations, often glyphosate resistant, are becoming established in areas where Palmer amaranth has not previously been found such as Wisconsin, Michigan, and Northern Indiana.

**Confirmed and suspected cases of glyphosate-resistant Palmer amaranth and year of initial observation in North-Central and Southern states** (Heap 2013, Legleiter and Johnson 2012).




### Spread of Palmer amaranth into new areas

- Palmer amaranth seed is believed to have moved north along with cotton seed and hulls brought from the southern U.S. for use in dairy and beef rations.
- Subsequent spreading of cattle manure distributed Palmer amaranth seed in fields and allowed populations to become established.

## Palmer amaranth identification

- Pigweeds can be highly variable in plant shape, leaf shape, and color, making identification a challenge.
- Waterhemp and Palmer amaranth are both dioecious (separate male and female plants), unlike other weedy pigweed species.


Fig. 1

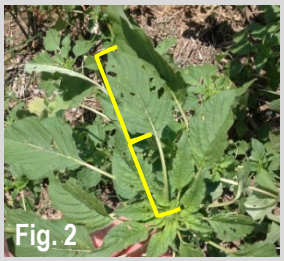


Fig. 2

### Palmer amaranth

- Smooth, hairless stem
- Diamond-shaped leaves
- Poinsettia-like rosette leaf arrangement when viewed from above (Fig. 1)
- Long petioles, often longer than the leaves (Fig. 2)
- Spiny bracts on the seed heads of female plants (Fig. 3)


Fig. 3

### Waterhemp (Fig. 4)

- Smooth, hairless stem.
- Leaves are often longer and narrower than other pigweeds.

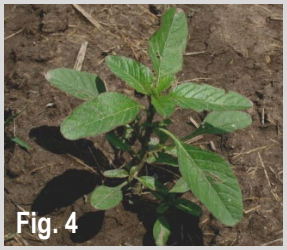


Fig. 4

**Palmer amaranth (left ) and waterhemp (right).**

## What makes Palmer amaranth such a difficult weed?

- Like all pigweeds, Palmer amaranth is a $C_4$ species, making it very efficient at fixing carbon and well-adapted to high temperatures and intense sunlight.
- It originated in the southwestern U.S. and has high water-use efficiency, allowing it to thrive in drought conditions
- Female plants can produce over 500,000 seeds each.
- Plants can germinate and emerge throughout the summer, making them difficult to manage in crops.
- Cross-pollination between plants increases genetic diversity and favors development and spread of herbicide resistance.
- It has a very rapid growth rate and is generally considered the most competitive of the pigweeds. Plants can grow in excess of 2 inches per day during the summer.

# Managing Palmer amaranth

## Scouting and proper identification

- Palmer amaranth's rapid growth rate, extended emergence window, and propensity for herbicide resistance make it the most challenging of the pigweed species to manage, so it is important to be able to distinguish it from other species.
- Pigweed species are difficult to tell apart during early vegetative growth stages, so fields need to be scouted later in the season for weed escapes to determine which pigweed species are present.
- Scouting guides can help with accurate identification.
  http://www.extension.iastate.edu/publications/PM1786.pdf
  http://bulletin.ipm.illinois.edu/pastpest/articles/200122g.html

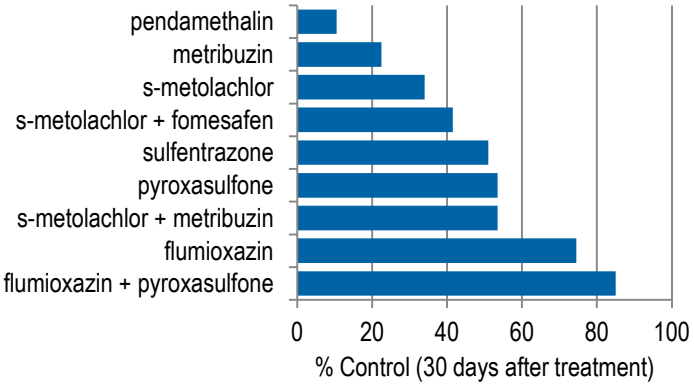
## Keys to managing Palmer amaranth

- Plant into a clean seedbed. Control early emerging weeds with tillage or a burndown treatment.
- Use a residual pre-emergence product that provides good control of Palmer amaranth
- Apply post-emergence treatments at the weed size specified by the label. Post-emergence herbicides often need to be applied when plants are only a few inches tall for maximum effectiveness.
- Tank mix a residual product with post-emergence applications to reduce late-emerging plants.
- It is unlikely that herbicides will provide complete control. Cultivation or hand weeding may be necessary to prevent escaped plants from producing seed.

## Herbicide options for glyphosate-resistant populations

- Several pre-emergence herbicide options are available in corn. Post-emergence options include herbicides containing atrazine, growth regulators such as 2,4-D or dicamba, and 4-HPPD inhibitors such as mesotrione.
- Several pre-emergence herbicide options are available in soybean. Products containing flumioxazin such as DuPont™ Envive® and Enlite® have been shown to provide the best residual activity.
- Post-emergence control options in soybean are very limited.
  - Resistance to ALS-inhibitors in Palmer amaranth is already widespread.
  - PPO-inhibitor herbicides are generally a viable option for control of emerged plants. Resistance to PPO-inhibitors has not been confirmed in Palmer amaranth, although instances of poor control have been reported.
  - Glufosinate is another post-emergence option in Pioneer® brand soybean with the LibertyLink® trait.

**Average Palmer amaranth control with pre-emergence herbicides in a two year Michigan State University study.** (Powell and Sprague 2012).




**Maximum recommended height or growth stage for best control of Palmer amaranth with post-emergence herbicides in soybean**.

| Active Ingredient | Herbicide | Weed Size |
|---|---|---|
| fomesafen | Flexstar®/Reflex® (1 pt)<br>Flexstar/Reflex (1.25 pt)<br>Flexstar/Reflex (1.5 pt) | 4 leaf<br>6 leaf<br>6 leaf |
| lactofen | Cobra® (12.5 fl oz) | 6 leaf |
| glufosinate* | Liberty® (22 fl oz)<br>Liberty (29 fl oz) | —<br>4 inches |



Davis, V.M. 2011. Palmer amaranth is in Wisconsin crop production fields. Univ. of Wisconsin Ext. http://ipcm.wisc.edu/blo g/2011/11/palmer-amaranth-is-in-wisco nsin-crop-production-fields/
Heap, I. 2013. The International Survey of Herbicide Resistant Weeds. Online. Internet. Thursday, May 02, 2013 . Available www.weedscience.org
Legleiter, T. and B. Johnson. 2012. Palmer Amaranth Populations Confirmed in Indiana. Purdue Univ. Extension. www.btny.purdue.edu/weedscience
Powell, D.K. and C.L. Sprague. 2012. Efficacy of PRE and POST herbicides for controlling multiple-resistant Palmer amaranth in Michigan. 2012 NCWSS Proceedings.
Sprague, C.L. 2012. Glyphosate-resistant Palmer amaranth in Michigan: Confirmation and management options. Mich State. Univ. Ext. http://www.msuweeds.com/assets/ExtensionPubs/Palmer-Glyphosate-Confirmation-Feb12.pdf

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