

Glyphosate-resistant Palmer pigweed Bulletin

Palmer pigweed (*Palmer amaranth*), the king of all pigweeds, is the fifth glyphosate-resistant weed species to be documented in the United States. As the dominant pigweed species in the South, it is the first weed to develop resistance to glyphosate in the U.S. that has the potential to inflict catastrophic damage if the problem becomes widespread. Weed scientists report that it could change the way growers farm.

As no new herbicide modes of action will be available in the foreseeable future, it is critical that practices are adopted to preserve glyphosate technology. Utilizing proper cultural and chemical management practices can reduce selection pressure placed on resistant biotypes and can help delay resistance.

Management Options

Preserving herbicides, particularly glyphosate, involves a well-rounded management program. A critical component of this is building programs around residual herbicides to extend weed control between applications. Rotating modes of action and limiting the frequency of glyphosate applications are also key to preserving this integral part of modern agriculture. For cotton, Syngenta recommends using no more than three in-crop applications per year if the glyphosate application is rotated with in-crop cultivation. In corn and soybeans, Syngenta recommends using no more than two applications of glyphosate on one field over a two-year period.

In addition to mode of action rotation and glyphosate use recommendations, Syngenta suggests the following weed resistance management practices:

- Scout fields thoroughly and regularly to know what weeds are present
- Use full labeled herbicide rates

- Apply when weeds are small (follow label directions)
- Control weed escapes — don't let weeds produce seed
- Avoid spreading seed through machinery or people by thoroughly cleaning machinery and clothing between fields
- Control weeds in fence rows and ditches

The Importance of Burndown

Burndown applications are a good way to start fields clean and break the continuous cycle of glyphosate use. Gramoxone Inteon™ is a proven performer in spring burndown applications for control of glyphosate-resistant Palmer pigweed and is an ideal alternative to glyphosate.

For specific control options, Syngenta recommends a variety of choices to fit individual needs. Always read and follow label instructions before using these products.

cotton	Weed control plan in no-till cotton	Program (rate/A)	Number of modes of action per program	Considerations
	Glyphosate-tolerant (GT)/ Roundup Ready® Flex programs			
	Burndown / At-planting recommendations	Gramoxone Inteon (2.5-3 pt) tank mixed with residual herbicides such as Caparol® (1.5 pt)	7	Residual herbicides included; excellent diversity of modes of action
	At-planting recommendations	Reflex® (rate dependent on coarse soil type) plus DNA herbicide such as Prowl® H20		
In-crop recommendations	Sequence® (2.5 pt) at 3-inch cotton, Envoke® (0.1-0.15 oz) after 5-leaf stage, Suprend® (1.0 lb) plus Touchdown Total™ (24 oz) at layby			

soybeans	Weed control plan in no-till soybeans	Program (rate/A)	Number of modes of action per program	Considerations
	Non-GT Soybeans			
	Burndown recommendations	Gramoxone Inteon (2.5-3 pt) alone	5	For growers who use more than one application of glyphosate in GT corn program
	In-crop recommendations	Dual Magnum® PRE (1-2 pt) followed by Fusion® (8-10 oz) plus Flexstar® (16-20 oz as needed)		
GT Soybeans				
Burndown recommendations	Gramoxone Inteon (2.5-3 pt) alone	4	Flexible POST application; early-season weed control	
In-crop recommendations	Sequence (2.5-3.5 pt applied at V1-3) followed by Flexstar (16-20 oz as needed) OR Prefix™ applied pre-emergence followed by Touchdown Total (24 oz) OR Dual Magnum (1-2 pt) followed by Touchdown Total (24 oz) plus Flexstar (6-10 oz)			

peanuts	Weed control plan	Program (rate/A)	Number of modes of action per program	Considerations
	Conventional System			
In-crop recommendations	Dual Magnum (1-1.3 pt) plus Gramoxone Inteon (8-16 oz) at cracking or up to 28 days after ground crack	2	Dual Magnum may be applied pre-emergence or post-emergence	

corn	Weed control plan in no-till corn	Program (rate/A)	Number of modes of action per program	Following season glyphosate applications
	Non-GT Corn Option 1 Burndown/At-planting recommendations	Gramoxone Inteon (2.5-3 pt) tank mixed with residual herbicides such as Bicep II Magnum® (1.6-2.1 qt) or Lexar® (3-3.5 qt)		
	In-crop recommendations	Spirit® applied as needed	5	2 applications
Non-GT Corn Option 2 Burndown/At-planting recommendations	Gramoxone Inteon (2.5-3 pt) in tank mix with Bicep II Magnum (1.6-2.1 qt)			
	In-crop recommendations	Callisto® (3 oz) plus AAtrex® (1 pt) early post (less than 12-inch corn)	4	2 applications
GT Corn Option 1 Burndown/At-planting recommendations	Gramoxone Inteon (2.5-3 pt) tank mixed with residual herbicides such as Bicep II Magnum (1.6-2.1 qt) or Lexar (2.5 qt)			
	In-crop recommendations	Touchdown Total (24 oz) as needed	4/5	2 applications
GT Corn Option 2 Burndown/At-planting recommendations	Gramoxone Inteon (2.5-3 pt) alone			
	In-crop recommendations	Sequence (2.5 pt) or Expert® (2.5 qt)	3/4	2 applications

Figure 1.

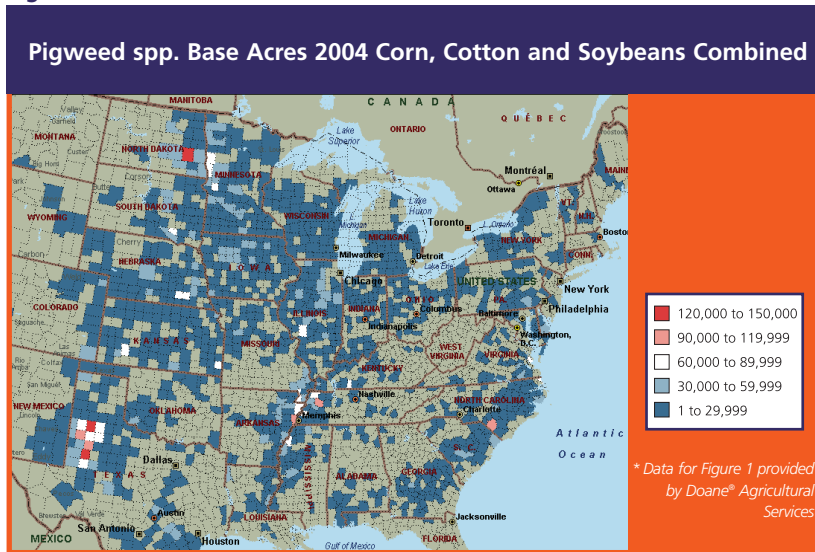
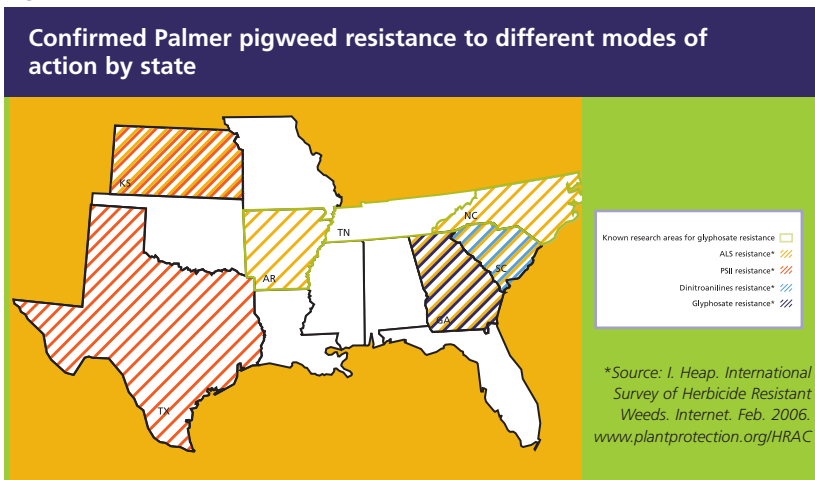


Figure 2.



Palmer Pigweed Resistance

Weed resistance is the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide that would normally be lethal. Resistance occurs when a particular mutation is selected and enriched in a weed population.

The widespread distribution and high density of Palmer pigweed in the South reinforces the need to carefully monitor fields and be aware of escapes. Multiple resistance is also a threat with Palmer pigweed, particularly in areas such as in Georgia where ALS resistance is already documented. In addition, Palmer pigweed has been proven to hybridize with other *Amaranthus* species.

As Figure 1 denotes, there are many areas throughout the United States that are battling severe pigweed infestations. When you throw hybridization and herbicide-resistant populations into the mix, particularly ALS resistance, this competitive weed can be even more challenging.

As shown by Figure 2, Palmer pigweed has documented resistance to several modes of action.



Palmer pigweed
Amaranthus palmeri

Numerical system to describe modes of action as designated by the Weed Science Society of America (WSSA):

Product	WSSA Group	Mode of Action
AAtrex	5 (Atrazine)	Inhibition of photosynthesis at Photosystem II (PSII), different binding behavior than groups 6 & 7
Bicep II Magnum	15 (S-Metolachlor)	Inhibition of long chain fatty acids (inhibition of cell division)
	5 (Atrazine)	Inhibition of photosynthesis at Photosystem II (PSII), different binding behavior than groups 6 & 7
Callisto	27 (Mesotrione)	Bleaching: Inhibition of 4-hydroxyphenyl-pyruvate-dioxygenase (4-HPPD)
Caparol	5 (Prometryn)	Inhibition of photosynthesis at Photosystem II (PSII), different binding behavior than groups 6 & 7
Dual Magnum	15 (S-Metolachlor)	Inhibition of long chain fatty acids (inhibition of cell division)
Envoke	2 (Trifloxysulfuron)	Inhibition of acetolactate synthase ALS (acetohydroxyacid synthase AHAS)
Expert	5 (Atrazine)	Inhibition of photosynthesis at Photosystem II (PSII), different binding behavior than groups 6 & 7
	9 (Glyphosate)	EPSP (5-enolpyruvyl-shikimate-3-phosphate) synthase inhibition
	15 (S-Metolachlor)	Inhibition of long chain fatty acids (inhibition of cell division)
Flexstar	14 (Fomesafen)	Inhibition of protoporphyrinogen oxidase (Protox)
Fusion	1 (Fluazifop-P-butyl)	ACCase inhibition (inhibition of fatty acid synthesis)
	1 (Fenoxaprop-P-ethyl)	ACCase inhibition (inhibition of fatty acid synthesis)
Gramoxone Inteon	22 (Paraquat)	Photosystem I electron diversion
Lexar	27 (Mesotrione)	Bleaching: Inhibition of 4-HPPD
	15 (S-Metolachlor)	Inhibition of long chain fatty acids (inhibition of cell division)
	5 (Atrazine)	Inhibition of photosynthesis at Photosystem II (PSII), different binding behavior than groups 6 & 7
Prefix	15 (S-Metolachlor)	Inhibition of long chain fatty acids (inhibition of cell division)
	14 (Fomesafen)	Inhibition of protoporphyrinogen oxidase (Protox)
Prowl H20	3 (Pendimethalin)	Microtubule assembly inhibition
Reflex	14 (Fomesafen)	Inhibition of protoporphyrinogen oxidase (Protox)
Sequence	15 (S-Metolachlor)	Inhibition of long chain fatty acids (inhibition of cell division)
	9 (Glyphosate)	EPSP synthase inhibition
Spirit	2 (Prosulfuron) (Primisulfuron-methyl)	ALS inhibition
Suprend	2 (Trifloxysulfuron)	ALS inhibition
	5 (Prometryn)	Inhibition of photosynthesis at Photosystem II (PSII), different binding behavior than groups 6 & 7
Touchdown Total	9 (Glyphosate)	EPSP synthase inhibition

For more information, contact the Syngenta Customer Center at

1-866-SYNGENTA (866-796-4368) or log on to resistancefighter.com.

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