

## **Managing Glyphosate-Resistant and ALS-Resistant Palmer Amaranth (Pigweed) in Soybeans, Field Corn, and Peanuts - 2007**

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The occurrence of herbicide resistance in Palmer amaranth in Georgia is cause for significant concern for the agricultural industry. Recent changes in cropping practices, specifically the reliance on a limited number of herbicides, have streamlined weed management. However, the consequence has been the development of herbicide resistance. The following recommendations in Tables 1-3 are aimed at preserving the herbicide tools that are available for weed management. An effective herbicide resistant weed management plan will require the integration of multiple herbicide chemistries in an effort to lessen the selection pressure and delay the occurrence of herbicide resistance in a field. Other strategies, such as cultural practices and mechanical cultivation should also be included in a herbicide resistant weed management plan. For additional information about herbicide resistant weeds, visit the UGA Weed Science Web-Page at the following web address:

<http://www.cropsoil.uga.edu/weedsci/resistance.html>

**Table 1. Herbicide programs for managing glyphosate and ALS-resistant Palmer amaranth in Georgia soybeans.**<sup>1</sup> (E.P. Prostko and J. Woodruff)

Soybean variety	Preemergence	First postemergence <sup>2</sup>	Second postemergence <sup>3</sup>
Roundup Ready	Dual Magnum <sup>4</sup> , Intro <sup>5</sup> , Outlook, or Prowl <sup>5</sup>	glyphosate + Reflex <sup>6</sup> or glyphosate + Ultra Blazer <sup>6</sup> or glyphosate + Cobra <sup>6</sup> or Sequence <sup>7</sup>	Reflex <sup>6</sup> or Ultra Blazer <sup>6</sup> or Cobra <sup>6</sup>
Roundup Ready	Valor <sup>6</sup>	glyphosate + Reflex <sup>6</sup> or glyphosate + Ultra Blazer <sup>6</sup> or glyphosate + Cobra <sup>6</sup> or Sequence <sup>7</sup>	
Roundup Ready	Reflex <sup>6</sup>	glyphosate + Ultra Blazer <sup>6</sup> or glyphosate + Cobra <sup>6</sup> or Sequence <sup>7</sup>	
Conventional	Prowl <sup>5</sup> + Valor <sup>6</sup> or Reflex <sup>6</sup>	Reflex <sup>6</sup> or Ultra Blazer <sup>6</sup> or Cobra <sup>6</sup>	
Conventional	Canopy or Sencor <sup>5</sup> + Dual Magnum <sup>4</sup> , Intro <sup>5</sup> , Outlook or Prowl <sup>5</sup>	Reflex <sup>6</sup> or Ultra Blazer <sup>6</sup> or Cobra <sup>6</sup>	Reflex <sup>6</sup> or Ultra Blazer <sup>6</sup> or Cobra <sup>6</sup>
Conventional	Boundary <sup>8</sup>	Reflex <sup>6</sup> or Ultra Blazer <sup>6</sup> or Cobra <sup>6</sup>	Reflex <sup>6</sup> or Ultra Blazer <sup>6</sup> or Cobra <sup>6</sup>

<sup>1</sup> Glyphosate- and ALS-resistant Palmer amaranth are very serious concerns. An aggressive management program is necessary to slow spread of resistant biotypes and to reduce selection pressure in areas currently not infested with resistant biotypes.

<sup>2</sup> When applied in combination with glyphosate, use either 12 oz/A of Reflex, 1.0 pt/A of Ultra Blazer, or 10-12.5 ozs/A of Cobra. Applications should be made **before** Palmer amaranth exceeds 2" in height.

<sup>3</sup> A second postemergence application will usually not be needed. If Reflex was applied earlier, use Ultra Blazer or Cobra for second application. Do not make a second application of Reflex. The total amount of these herbicides that can be applied per acre per year are as follows: Cobra - 25 ozs/A; Reflex - 1.5 pt/A; and Ultra Blazer - 2.0 pt/A. Reflex may be preferred because of residual control of Palmer amaranth. On Roundup Ready soybean, glyphosate can be included in the second application if needed for the control of other weeds.

<sup>4</sup> Generic brands containing metolachlor are available (Me-Too-Lachlor, Parallel PCS, Stalwart). However, these generic brands may not provide the same length of residual control as Dual Magnum (S-metolachlor).

<sup>5</sup> Generic brands of Intro (alachlor), Sencor (metribuzin) and Prowl (pendimethalin) are available and perform similarly. When using Sencor or Canopy, follow label for appropriate rates, soil pH restrictions, and soybean variety tolerance.

<sup>6</sup> Valor, Cobra, Reflex, and Ultra Blazer have the same mode of action (PPO inhibitor). Consequently, no more than 2 applications of these herbicides should be used in a season.

<sup>7</sup> Sequence is a pre-mixture of glyphosate and S-metolachlor. Sequence will not control emerged glyphosate resistant pigweed.

<sup>8</sup> Boundary is a pre-mixture of metribuzin and S-metolachlor.

**Table 2. Herbicide programs for managing glyphosate and ALS-resistant Palmer amaranth in Georgia field corn.** <sup>1</sup>(E.P. Prostko and R. D. Lee)

Corn hybrid	Preemergence	Postemergence	Layby as needed
Conventional	Atrazine**	Prowl <sup>2</sup> + Atrazine + Crop Oil	2,4-D <sup>5</sup> or Evik
Conventional	Bicep II Magnum <sup>3</sup> , or Bullet, or Guardsman, or Lariat, or Lexar	Atrazine or Banvel/Clarity <sup>4,5</sup> , or 2,4-D <sup>5</sup> , or Aim, or Callisto	2,4-D <sup>5</sup> or Evik
Liberty Link	Atrazine** or Dual II Magnum <sup>6</sup> or Outlook	Liberty + atrazine <sup>7</sup>	2,4-D <sup>5</sup> or Evik
Roundup Ready	Atrazine**	glyphosate + atrazine or Expert <sup>8</sup> or Sequence <sup>9</sup>	2,4-D <sup>5</sup> or Evik
Roundup Ready	Bicep II Magnum <sup>3</sup> , or Bullet, or Guardsman, or Lariat, or Lexar at 66% normal rate	glyphosate + atrazine or Expert <sup>8</sup> or Sequence <sup>9</sup>	2,4-D <sup>5</sup> or Evik

<sup>1</sup>Glyphosate- and ALS-resistant Palmer amaranth are very serious concerns. An aggressive management program is necessary to slow spread of resistant biotypes and to reduce selection pressure in areas currently not infested with resistant biotypes.

<sup>2</sup>Generic brands of Prowl (pendimethalin) are available and perform similarly.

<sup>3</sup>Bicep II Magnum is a pre-mixture of S-metolachlor and atrazine. Less expensive, generic brands containing metolachlor and atrazine are available (Parallel Plus, Stalwart Xtra). These generic brands may not provide the same length of residual control as Bicep II Magnum (which contains S-metolachlor).

<sup>4</sup>Generic brands of Banvel (dicamba dimethylamine salt) are available and perform similarly.

<sup>5</sup>Use extreme caution to avoid drift to sensitive crops, such as cotton, tobacco, soybeans, and vegetables. Use only amine formulations of 2,4-D. Follow all label directions for drift management.

<sup>6</sup>Generic brands containing metolachlor are available (Me-Too-Lachlor-II, Parallel, Stalwart-C). However, these generic brands may not provide the same length of residual control as Dual II Magnum (S-metolachlor).

<sup>7</sup>Also available in a pre-mixture sold under the trade name of Liberty ATZ.

<sup>8</sup>Expert is a pre-mixture of glyphosate, S-metolachlor and atrazine.

<sup>9</sup>Sequence is a pre-mixture of glyphosate + S-metolachlor.

**\*\* When atrazine is applied PRE + POST, a total of 2.5 lbs ai/A can be applied per year (2.5 qts/A of 4L or 44 ozs/A of 90DF). When atrazine is applied only POST, then a total of 2.0 lb ai/A can be applied per year (2 qts/A of 4L or 36 ozs/A of 90DF).**

**Table 3. Herbicide programs for managing ALS-resistant Palmer amaranth in Georgia peanut.** <sup>1</sup>  
(E.P. Prostko, T.L Grey, and W.C. Johnson, III)

Preplant Incorporated	Preemergence <sup>2</sup>	Cracking or early postemergence <sup>3</sup> (Palmer < 2 in.)	Postemergence <sup>4</sup> (Palmer < 3 in.)
Prowl <sup>5</sup> or Sonalan	Valor <sup>6,7</sup>		Cobra <sup>7</sup> or Ultra Blazer <sup>7</sup>
Prowl <sup>5</sup> or Sonalan	Valor <sup>6,7</sup> + Dual Magnum <sup>8</sup> or Outlook		Cobra <sup>7</sup> or Ultra Blazer <sup>7</sup>
Prowl <sup>5</sup> or Sonalan	Dual Magnum <sup>8</sup> or Outlook	Paraquat <sup>9</sup> + Basagran or Storm <sup>7</sup>	Cobra <sup>7</sup> or Ultra Blazer <sup>7</sup>
Prowl <sup>5</sup> or Sonalan		Paraquat <sup>9</sup> + Basagran or Storm <sup>7</sup> + Dual Magnum <sup>8</sup> or Outlook	Cobra <sup>7</sup> or Ultra Blazer <sup>7</sup>

<sup>1</sup> ALS-resistant Palmer amaranth is a very serious concern. An aggressive, broad-based management program is necessary to slow spread of the resistant biotypes and to reduce selection pressure in areas currently not infested with resistant biotypes. A combination of soil residual and postemergence herbicides will be required for optimum control.

<sup>2</sup> Strongarm is not included in this table because it is an ALS-inhibiting herbicide. However, it can be used for the control of other broadleaf weeds. If Strongarm is used preemergence, Cadre or Pursuit should **NOT** be applied postemergence.

<sup>3</sup> Apply cracking or early postemergence treatment only if weeds have emerged.

<sup>4</sup> Cadre or Pursuit may be tank-mixed with Cobra or Ultra Blazer if needed for control of other weed species. Cadre and Pursuit are ALS- inhibitors. Because of concerns with weed resistance to ALS-inhibitors, a mixture of Cobra or Ultra Blazer with Cadre or Pursuit would be preferred over Cadre or Pursuit alone. When using Cadre or Pursuit, follow all labeled crop rotation restrictions.

<sup>5</sup> Generic brands of Prowl (pendimethalin) are available and perform similarly. Prowl or Sonalan can be used preemergence if 0.5-0.75" of water can be applied within 48 hours of application. They can be tank-mixed with Valor, Dual Magnum, or Outlook in this situation. Dual Magnum and Outlook may also be applied preplant incorporated in combination with Prowl or Sonalan if desired.

<sup>6</sup> If Valor is properly activated with 0.5-0.75" of rainfall or irrigation within 7 days of application, it is unlikely that an "at-cracking" treatment will be required. However, if control with Valor is unacceptable, an "at-cracking" treatment of paraquat + Basagran + Dual Magnum or Outlook should be applied.

<sup>7</sup> Valor, Cobra, Storm, and Ultra Blazer have the same mode of action (PPO inhibitor). Consequently, no more than a total of 2 applications of these herbicides should be used in a season.

<sup>8</sup> Generic brands of metolachlor are available (Stalwart, Parallel PCS, Me-Too-Lachlor). However, these generic brands have not provided the same length of residual control as Dual Magnum (S-metolachlor) in some UGA field trials.

<sup>9</sup>Paraquat is sold under the trade names of Gramoxone Inteon or Firestorm.