

One of the most important aspects of soybean production is weed management. Uncontrolled weeds not only reduce soybean yields through their competition for light, nutrients, and moisture, but they can also severely reduce harvest efficiency. Before implementing a weed management plan for soybeans, several factors need to be considered including weed species, rotational crops, and cost/A.

### Georgia's Soybean Weed Problems

Recent surveys of county extension agents in Georgia indicated that the top 10 most troublesome weeds in soybeans are as follows: 1) sicklepod; 2) morningglory spp.; 3) pigweed spp.; 4) nutsedge spp.; 5) Texas panicum; 6) cocklebur; 7) Florida beggarweed; 8) bristly starbur; 9) bermudagrass; and 10) coffee senna.

### Weed Competition in Soybeans

If a weed management program in soybeans is going to be successful and economical, a thorough understanding of the competitive effects of weeds is important. In regards to this area, two things must be considered: 1) When do the weeds need to be controlled in order to prevent significant yield losses? and 2) How much yield loss are they actually causing? Research has shown that weeds that emerge just prior to or at the same time as the soybeans cause greater yield losses than later emerging weeds. Consequently, effective weed control during the initial 2 to 4 weeks after soybean emergence usually prevents yield losses due to weed competition. However, later emerging weeds can have a negative influence on seed quality and harvest efficiency. Other research has shown that soybean plants can tolerate a certain level of weed pressure and that control strategies should only be implemented when the potential yield losses caused by the weeds exceeds the cost of control (i.e. economic threshold concept). The following table illustrates the influence of various weed species on soybean yield:

**Table 1. Number of weeds/100 feet of row that cause yield reductions in soybeans.**

Weed	Soybean Yield Loss (%)					
	1	2	4	6	8	10
Cocklebur or giant ragweed	1	2	4	6	8	10
Pigweed or lambsquarters	2	4	6	10	15	20
Morningglory or velvetleaf	8	16	24	32	40	50
Smartweed or jimsonweed	2	4	6	10	15	20

Source: Pike, D. R. 1999. *Economic Thresholds for Weeds*. University of Illinois, Cooperative Extension. Available on-line at [http://web.aces.uiuc.edu/vista/pdf\\_pubs/ECTHR.PDF](http://web.aces.uiuc.edu/vista/pdf_pubs/ECTHR.PDF).

The most effective weed management programs in soybeans use a combination of cultural, mechanical, and chemical control strategies. Cultural practices include such factors as planting date, planting rate, and row spacing. Cultural practices improve weed control by enhancing the competitive ability of the soybeans. Mechanical practices, such as cultivation, are a non-chemical method for controlling weeds between rows. A multitude of herbicides are labeled for use in soybeans and can be applied preplant incorporated, preemergence, postemergence, and post-directed. A complete update on the herbicides recommended for use in Georgia can be found at the end of this section. Because there are an extensive number of herbicides labeled for use in soybeans, just about any weed problem that arises can be controlled. It is just a matter of how much money can be economically justified for weed control in soybeans.

**Roundup Ready Soybeans**

It has been estimated that 92% of the soybeans planted in the U.S. during 2008 were herbicide resistant varieties. Producers have become very interested in the Roundup Ready (glyphosate) soybean system because it is a relatively easy system to use.

Glyphosate is an excellent herbicide for the control of most weeds but **not** all weeds. Weeds such as morningglory, yellow/purple nutsedge, dayflower/tropical spiderwort, hemp sesbania, prickly sida, and Florida pusley are not readily controlled by glyphosate. Consequently when these species are present, a soil-applied residual herbicide will be needed or an additional herbicide should be used in a tank-mix. In general, 2 applications of glyphosate will be needed for optimum weed control. However, it is possible in narrow soybean production systems that 1 application will be adequate. It cannot be overemphasized enough that it is crucial when using the Roundup Ready system to select a well-adapted RR soybean variety. Ease of weed control is no substitute for a low yielding variety.

**Tank-Mixes with Glyphosate for Improved Morningglory Control in RR Soybeans??**

One of more common weeds that glyphosate has not provided consistent control of is morningglory. Single applications have rarely been adequate to control this weed complex. Split applications of glyphosate will provide better morningglory control than single applications but many producers are reluctant to pay the additional application and herbicide costs. Tank-mixes with other broadleaf herbicides can help to improve the control of morningglory at a reduced cost compared to split applications. However in most cases, the addition of these herbicides has only resulted in a 5 to 10% increase in morningglory control. Morningglory control with glyphosate can also be greatly improved by making a timely application **before** the weed exceeds 2" in height.

**Table 2. Potential tank-mixes with glyphosate to improve morningglory control.**

Herbicide	Rate/A
Classic 25DF	0.25 - 0.33 ozs
FirstRate 84WDG	0.15 - 0.20 ozs
Resource 0.86EC	4 ozs

## Nutsedge Management in RR Soybeans

Potential nutsedge control strategies in the RR soybean production system include the following:

1. Two postemergence applications of glyphosate (14 days apart). This treatment will be more effective on purple nutsedge than yellow nutsedge.
2. Classic tank-mixed with glyphosate. This treatment will control yellow and suppress purple.
3. Pursuit tank-mixed with glyphosate. This combination will be more effective on purple than yellow. A pre-mixed combination of Pursuit + glyphosate is sold under the trade name of Extreme.

Soil-applied herbicides that have fair to good activity on yellow nutsedge include the following: Canopy, Dual Magnum, Envive, Intro, Prefix, Pursuit, Reflex, and Scepter.

## Sicklepod Control

Sicklepod is the number one weed problem in Georgia soybeans. Although it is considered to be less competitive than many other weeds, sicklepod populations can quickly reach levels that can cause significant yield loss. Fortunately, several control strategies for this weed are available.

In conventional soybeans, the best method to control sicklepod is to use a systems approach that includes a preplant incorporated or preemergence application of Sencor (metribuzin), Canopy (metribuzin + chlorimuron), or Boundary (metribuzin + *S*-metolachlor) followed by a postemergence application of Classic. Caution is advised when using metribuzin products because several restrictions on soil type, organic matter, pH, and variety exist. Refer to the specific herbicide label for these restrictions. Python (flumetsulam) can be substituted for metribuzin products in those situations where metribuzin use would be prohibited or not preferred.

Sicklepod is also very susceptible to glyphosate thus can be managed using the RR production system. However, 2 applications of glyphosate may be required to provide season-long control.

## Controlling RR Cotton in RR Soybeans

The management of volunteer RR cotton in RR soybeans has become a concern for many Georgia growers. RR cotton control strategies should include a combination of both preemergence and postemergence herbicide applications.

**Table 3. Herbicide Programs for Managing Volunteer RR Cotton in RR Soybeans<sup>1</sup>**

Preemergence	Postemergence <sup>2</sup>
Canopy 75DG (6-8 oz/A <sup>3</sup> ) or Sencor 4L (8-12 oz/A <sup>3</sup> ) or Sencor 75DF (5.3-8 oz/A <sup>3</sup> )	glyphosate + Resource (4 oz/A), or 2,4-DB (2 oz/A), or Reflex (12 oz/A), or Classic (0.33 oz/A)

<sup>1</sup>A combination of preemergence and postemergence herbicides is needed to provide optimum control.

<sup>2</sup>Postemergence applications should be made when cotton is 6" or less. <sup>3</sup>Rate depends upon soil type. Refer to label.

## Controlling RR Corn in RR Soybeans

The following grass herbicides can be added to glyphosate for the control of RR corn in RR soybeans:

**Table 4. Grass herbicides that can be tank-mixed with glyphosate to control RR corn in RR soybeans.**

Herbicide*	Corn Size (in)	Rate/A (ozs)
Arrow/Select	4-12	4-6
	12-24	6-8
Assure II/Targa	1-12	4
	12-18	5
	18-30	8
Fusilade	12-24	6-8
Poast	1-12	12
	12-20	16
Poast Plus	1-12	18
	12-20	24
SelectMax	4-12	8-12
	12-18	10-14
	18-24	12-16

## Glyphosate/Boron/Dimilin Tank-Mixes

A common soybean production practice in Georgia is to apply a combination of Dimilin + Boron at the R2 to R3 stage of growth. Numerous inquiries have been made about the potential for adding glyphosate to this treatment. Research conducted in Georgia and South Carolina indicated that the 3-way combination of glyphosate + Dimilin + Boron can be used in soybeans without concern for compatibility problems or excessive soybean injury.

However, it has been demonstrated in numerous studies that the best time to apply glyphosate is between the V2 and V3 stages for soybeans grown in 30" rows and between the VC and V4 stages for soybeans grown in 7.5" rows. Thus, single applications of glyphosate made at the R2 to R3 stage of growth are *too late* to provide the best level of weed control and optimal yields. The 3-way combination of glyphosate + Dimilin + boron would be much more effective when used following an earlier application of glyphosate applied at the appropriate time. If the 3-way combination is used, the rate of boron should not exceed 0.25 lb ai/A.

## Glyphosate/Manganese Tank-Mixes

Growers with soybeans that are exhibiting foliar manganese (Mn) deficiency symptoms should be cautious when considering tank-mixing Mn fertilizers with glyphosate. Research has shown that certain formulations of Mn, particularly Mn-EAA, Mn-LS, and MnSO<sub>4</sub>, applied in combination with glyphosate, can significantly reduce weed control. Consequently, split-applications would be preferred if these formulations of Mn are used. Mn-EDTA formulations of Mn have not reduced weed control when applied in combination with glyphosate.

MnSO<sub>4</sub> has not reduced the weed control performance of other herbicides such as Basagran/Pledge, Ultra Blazer, Classic, or Pursuit.

## Tropical Spiderwort Control

Tropical spiderwort, also known as hairy wandering jew or Bengal dayflower, has become an increasing problem in many soybean production fields. Planting in narrower rows and increasing soybean plant populations will help improve the control of tropical spiderwort through competition and shading.

The most effective herbicide control strategies for tropical spiderwort include using a combination of both preemergence and postemergence herbicides. One of the best soil applied herbicides for the control of tropical spiderwort is Dual Magnum (*S*-metolachlor). Generic formulations of metolachlor are available (Me-Too-Lachlor, Stalwart, and Parallel PCS) but these formulations have not provided the same length of residual control of tropical spiderwort as Dual Magnum in UGA trials. Postemergence herbicides that have fair to good activity on tropical spiderwort include Basagran, Classic, FirstRate, and Pursuit.

Gramoxone Inteon/Firestorm/Parazone or Aim can be used post-directed or in a hooded sprayer. When using Gramoxone Inteon/Firestorm/Parazone post-directed, the soybeans must be at least 8" in height and the herbicide should not be sprayed higher than 3" on the soybean plant.

In RR soybean systems, glyphosate can provide fair to good control of tropical spiderwort if it is applied to plants that are 3" tall or less and under ideal growing conditions. However, more effective control can be obtained by applying either Sequence or Extreme. Sequence is a pre-mix of glyphosate + Dual Magnum. Extreme is a pre-mix of glyphosate + Pursuit. Other herbicides which can be tank-mixed with glyphosate to improve control of tropical spiderwort include Classic or FirstRate.

## Herbicide Resistant Weeds

Herbicide resistant weed species can become a serious problem in fields when a single herbicide or herbicides with similar modes of action are used repeatedly. This phenomenon has been documented in Georgia with Palmer amaranth (pigweed) and other weed species (Table 5). Populations of Palmer amaranth have been found in the state that are resistant to glyphosate or ALS-inhibiting herbicides. Check with your county extension agent for updated information about the distribution of herbicide resistant weeds in your area.

**Table 5. Herbicide Resistant Weeds in Georgia.**

Weed	Year	Herbicide(s)	Site of Action
goosegrass	1992	Treflan	Tubulin protein
Prickly sida	1993	Scepter	ALS enzyme
Italian ryegrass	1995	Hoelon	ACCcase enzyme
Palmer amaranth	2000	Cadre, Pursuit	ALS enzyme
Palmer amaranth	2005	glyphosate	EPSP synthase
crabgrass	2007	Poast	ACCcase enzyme
Palmer amaranth	2007	atrazine	PS II
Italian ryegrass	2008	Osprey	ALS enzyme

Herbicide resistant weeds can be managed by using a combination of strategies including crop rotation, row patterns, mechanical cultivation, and utilizing herbicides with different modes of action.

Specific herbicide recommendations for the control of glyphosate-resistant Palmer amaranth and ALS-resistance management in soybeans are presented in the following table:

**Table 6. . Herbicide Programs for Managing Glyphosate/ALS-Resistant Palmer Amaranth and Delaying PPO Resistance in Soybeans.<sup>1</sup>**

Soybean variety	Preemergence <sup>2</sup>	Postemergence <sup>3,4</sup>
Roundup Ready	Sencor or Canopy <sup>5</sup> or Boundary <sup>6</sup>	glyphosate + Reflex <sup>7</sup> or glyphosate + Ultra Blazer <sup>7</sup> or glyphosate + Cobra <sup>7</sup> or glyphosate + Prefix <sup>7,8</sup> or Sequence <sup>9</sup>
Conventional	Sencor or Canopy <sup>5</sup> or Boundary <sup>6</sup> + Prowl	Reflex <sup>7</sup> or Ultra Blazer <sup>7</sup> or Cobra <sup>6,7</sup> or Prefix <sup>7,8</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>Generic brands of Sencor (metribuzin) and Prowl (pendimethalin) are available and perform similarly. When using Boundary, Sencor or Canopy, follow label for appropriate rates, soil pH restrictions, and soybean variety tolerance. Dryland growers should consider mechanically incorporating Sencor, Canopy, Boundary, and Prowl. If mechanically incorporating herbicides, Treflan can be used instead of Prowl if preferred.

<sup>3</sup>When applied in combination with glyphosate, use either 12-16 oz/A of Reflex, 1.0-1.5 pt/A of Ultra Blazer, or 12.5 ozs/A of Cobra. Applications should be made **before** Palmer amaranth exceeds 2" in height.

<sup>4</sup>If residual herbicides are activated by a timely rainfall or irrigation event, a second postemergence application will usually not be needed. 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>5</sup>Canopy is a pre-mixture of metribuzin (Sencor) + chlorimuron (Classic).

<sup>6</sup>Boundary is a pre-mixture of metribuzin (Sencor) and S-metolachlor (Dual Magnum).

<sup>7</sup>Valor, Envive, Cobra, Prefix, Reflex, Prefix, and Ultra Blazer have the same mode of action (PPO inhibitor). More than 1 application of these herbicides in a single season should be avoided if at all possible to prevent/delay the development of PPO resistance.

<sup>8</sup>Prefix is a pre-mixture of fomesafen (Reflex) and S-metolachlor (Dual Magnum).

<sup>9</sup>Sequence is a pre-mixture of glyphosate and S-metolachlor (Dual Magnum). Sequence will not control emerged glyphosate resistant pigweed.

**Soybean varieties that have exhibited acceptable tolerance to Sencor, Canopy, and Boundary in preliminary UGA tests conducted in 2008 include the following:**

- |                        |                        |
|------------------------|------------------------|
| Ag South AGS 568       | Asgrow H7242           |
| Asgrow 4903 RR/STS     | Delta Pineland DP 5634 |
| Delta Pineland DP 6568 | Northrup King NKS 80P2 |
| Northrup King NKS 76L9 | Northrup King NKS 78G6 |
| Pioneer 95Y40          | Pioneer 95Y70          |
| Pioneer 96M60          | Pioneer 97M50          |
| Southern States RT5951 | Southern States RT4808 |
| Vigoro V61N9           | Vigoro V74N9           |

**\*\*Soybean varieties not included in this list have not been adequately evaluated.**

## **Rotational Crop Concerns**

Advances in herbicide chemistry have led to the development of some exceptional families including the sulfonyleureas (Classic, Pinnacle), imidazolinones (Pursuit, Scepter), sulfonanilides (Python, Firstrate), and others. Many herbicides in these families are used in soybeans. However, some of these herbicides have the potential to injure rotational crops if the appropriate replanting interval is not observed. Because of the diversity of crops that are grown in Georgia, producers must consider the potential effects that herbicides could have on a rotational crop the next year. This information is readily available on nearly all herbicide labels.