



COOPERATIVE EXTENSION

College of Agriculture, Forestry and Life Sciences



2023 South Carolina Pest Management Handbook

Table of Measurements and Conversions

Standard Measure	Metric Conversion
Length: 1 ft = 12 in 1 yd = 3 ft 1 mi = 5,280 ft 1 mph = 88 ft/1 min	Length: 1 in = 25.4 mm = 2.54 cm 1 ft = 304.8 mm = 30.48 cm 1 yd = 914.4 mm = 91.44 cm = 0.914 m 1 mi = 1,609 m = 1.61 km 1 mm = 0.03937 in 1cm = 0.394 in = 0.0328 ft 1 m = 39.37 in = 3,281 ft 1 km = 3,281 ft = 0.621 mi
Area: 1 sq in = 0.007 sq ft 1 sq ft = 144 sq in 1 sq yd = 1,296 sq in = 9 sq ft 1 ac = 43,560 sq ft = 4,840 sq yd	Area: 1 sq in = 6.45 sq cm 1 sq ft = 929 sq cm 1 sq yd = 8,361 sq cm = 0.8361 sq m 1 ac = 4,050 sq m = 0.405 h 1 sq m = 1,550 sq in = 10.76 sq ft 1 ha= 107,600 sq ft = 2.47 ac
Volume: 1 tsp = 0.17 fl oz 1 tbs = 3 tsp 1 fl oz = 2 tbs = 6 tsp 1 cup = 8 fl oz = 16 fl oz 1 pt = 2 cups = 16 fl oz 1 qt = 2 pt = 32 fl oz 1 gal = 4 qt = 8 pt = 128 fl oz = 231 cu in Note: To convert liquid ounces to gallons, multiply by 0.0078125(.008)	Volume: 1 fl oz = 29.5 ml = 0.0295 L 1 pt = 437 ml = 0.437 L 1 qt = 945 ml = 0.945 L 1 gal = 3,785 ml = 3.785 L 1 ml = 0.033 fl oz 1 L = 33.8 fl oz = 2.112 pt = 1.057 qt = 0.264 gal
Weight: 1 oz = 0.0625 lb 1 lb = 16 oz 1 ton = 2,000 lb 1 gal of water = 8.34 lb	Weight: 1 oz = 28.35 g 1 lb = 454 g = 0.4536 kg 1 ton = 907 kg 1 gal of water = 3.786 kg 1 g = 0.035 oz 1 kg = 35.27 oz = 2.205 lb
Concentration: 1 part per million (ppm)= 0.00001 percent = 0.013 oz in 100 gal of water 1 percent = 10,000 ppm 0.1 percent = 1,000 ppm 0.01 percent = 100 ppm 0.001 percent = 10 ppm	Concentration: 1 part per million (ppm)= 1 milligram/liter = 1 milligram/kilogram 1 percent = 10 grams/liter 0.1 percent = 1,000 milligrams/liter 0.01 percent = 100 milligrams/liter 0.001 percent = 10 milligrams/liter
Temperature: To convert degrees Celsius (°C) to degrees Fahrenheit (°F): multiply by 1.8 and add 32. Example: 30 degrees °C = 86 degrees °F. (30x1.8+32) To convert degrees Fahrenheit (°F) to degrees Celsius (°C): subtract 32 multiply by 0.56. Example: 50 degrees °F = 10 degrees °C (50-32x0.56).	

Abbreviations: ac = Acr e; cm = Centimeter; fl oz = Fluid ounce; ft = Foot or Feet; g = Gram; gal = Gallon; ha = Hectare (1 ha = 10,000 square meters); in = Inch; kg = Kilogram; km = Kilometer; L = Liter; lb = Pound; mi = Mile; oz = Ounce; pt = Pint; m = Meter; mg = Milligram; min = Minute; ml = Milliliter; mm = Millimeter; qt = Quart; sq = Square; tbs = Tablespoon; tsp = Teaspoon; yd = Yard.

2023 South Carolina Pest Management Handbook

The Pest Management Handbook is a set of recommendations developed by Clemson University Extension pest management specialists and university researchers for South Carolina growers. These recommendations were derived from various sources of information available to these contributors at times prior to publishing this handbook and represent their current views on managing field crop pests based on pesticide labels, their own research or experience, and/or through other sources. The chemical recommendations provided here are based on pesticide active ingredients. Pesticide products mentioned here are for applicator convenience and are examples only.

The information in this publication was current as date of printing **January 31, 2023** and applies only to South Carolina. It may not be appropriate for other states or locations.

The 2023 Pest Management Handbook is also available as an electronic copy on the Clemson University Extension web page: <http://www.clemson.edu/extension/rowcrops/>

MyIPM

To complement the pest management handbook, a smartphone application called MyIPM for Row Crops is now available in the **Apple Store** and in the **Google Play Store** for free. The app includes descriptions and photos of key pests of row crops, and information on integrated pest management strategies, including registered pesticides for each pest. Developed by Clemson University and the Southern IPM Center, the app content is maintained in collaboration with university Extension scientists across the mid-Atlantic, southeastern, and southern U.S. For 2022, the app includes sections on insects in corn, cotton, grain sorghum, peanut, and soybean, and diseases in peanut. Additional sections on other pests and crops will be added in the future.

Links for the MyIPM for Row Crops App:

Apple Store iOS:

<https://apps.apple.com/us/app/myipm-row-crops/id1568195241>

Google Play Store:

<https://play.google.com/store/apps/details?id=com.bugwood.myipmcrops&hl=en>

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INTRODUCTION

SPRAYER CALIBRATION

Mike Marshall, Extension Weed Specialist

Accurate application of pesticides is essential to effectively control the pest of concern, avoid excessive crop injury, and minimize chemical costs and harm to the environment. This has become even more critical in recent years as some pesticide use rates go from pounds per acre to fractions of one ounce per acre. Unfortunately, sprayer calibration is often neglected or avoided. There are many ways to calibrate a sprayer, some more difficult than others. If you have a reliable method with which you are comfortable, stick with it. The following is a guide to a straightforward method.

Sprayer calibration should be done with clean water, *not with the chemical mix in the spray system*. Before you calibrate your sprayer, thoroughly clean it (see Sprayer Cleanout Section for more information). Also, be sure to check for nozzle output uniformity, as defects or uneven wear will cause some nozzles to put out significantly more than others of the same type. To do this, catch and measure the output of *each* nozzle for a specific length of time (30 seconds, 1 minute, etc.) and determine the average output per nozzle (total combined output of all nozzles divided by the number of nozzles). Discard and replace any nozzle that varies more than 5 percent from the average.

1/128 acre method:

This is perhaps the most frequently used and quickest method of calibration. It involves measuring a specific driving distance rather than an area. Follow these steps to calibrate by the 1/128 acre method.

1. Measure a specific distance in a field according to **table 1**. Select a driving distance which matches the nozzle spacing on your boom (for broadcast sprays) or row spacing you use (for band applications). The distance should be measured in a field typical of those you will be spraying, rather than a smooth surface.
2. Select a gear and engine speed combination which will allow you to comfortably drive across your fields and develop adequate spray pressure for the selected nozzles on your rig. Drive the measured distance at your preselected gear and engine speed combination and record the time required to drive the distance in *seconds*. To improve precision, you

may want to time two or more separate runs and take the average of two runs.

Table 1. Distance calibration table for sprayers

Nozzle or Row spacing (inches)	Distance to time for calibration (feet)	Nozzle or Row spacing (inches)	Distance to time for calibration (feet)
40	102	26	157
38	107	24	170
36	113	22	185
34	120	20	204
32	127	18	227
30	136	16	255
28	146	14	291

3. Park the sprayer and, using a measuring cup or bucket, catch the spray output from a single nozzle for the length of time it took you to drive the measured distance in step one. Be sure that the sprayer is running at the same engine speed and spray pressure. *Note:* For banding rigs where you used row spacing to determine the distance in step 1 and where more than one nozzle is directed to the row, catch the output for all nozzles directed to a single row.
4. The total amount of water, measured in ounces, collected per nozzle or row in step 3 equals gallons per acre (GPA).

Determining how much herbicide product to add to the spray tank:

Now that you have successfully calibrated your sprayer, the next step is to determine how much chemical you need to add to the tank.

1. Divide the tank capacity by gallons per acre to get the number of acres a full tank can spray:

$$[\text{Tank capacity (gallons)} \div \text{GPA}] = \text{Number of acres covered by one full tank}$$

2. Multiply the recommended pesticide rate from the label (pt/A, oz/A, lb/A, etc.) by the number of acres covered by a full tank (from step 1.)

- Note:** All pesticide rates in this handbook are given as *broadcast rates*. For *band applications*, you must adjust the rate using the following formula:

$$[\text{Band Width} \times \text{Broadcast Rate}] \div \text{Row Width} = \text{Band Rate}$$

Examples of calibration & how much to put in the tank.

Broadcast Application:

You plan to spray generic glyphosate herbicide, plus a nonionic surfactant for burn-down prior to planting cotton. Your sprayer has a uniform nozzle spacing of **18 inches**. You have thoroughly cleaned your sprayer and replaced all non-uniform nozzles (and yes there were some!)

- From **Table 1**, note that the distance to drive is **227 feet**. Measure this distance in the field to be sprayed.
- Set your throttle engine rpm to achieve the desired speed and drive the **227 feet** for several runs. Let's say that it took you an average of **39 seconds** to cover the distance.
- Now, at the same engine speed and at your desired spray pressure, and with your sprayer standing still, catch the output in *ounces* for 39 seconds from any *one* nozzle, the average time it took your rig to travel the 227 feet. You catch 20 ounces during the 39 second time period. Therefore, your sprayer output is **20 GPA**.
- After reading the generic glyphosate label and the weed control recommendations for cotton, you decide to spray glyphosate at **1 qt/A**, plus a nonionic surfactant at **1 qt/100 gallons** of spray mix. Let's assume you have a 500-gallon spray tank.

5. *How many acres will one tank load cover?*

$$[500 \text{ gal tank} \div 20 \text{ GPA}] = 25 \text{ acres covered by one tank load}$$

$$\text{So, } 1 \text{ qt/A} \times 25 \text{ acres} = 25 \text{ quarts } (\sim 6.25 \text{ gallons}) \text{ of glyphosate per tank load}$$

What about the surfactant:

$$500 \text{ gal} \times (1 \text{ qt}/100 \text{ gal}) = 5 \text{ qts. surfactant per spray tank load.}$$

Band Application:

You plan to apply Staple herbicide plus nonionic surfactant in a **19 inch band** on **38 inch rows**. Your banding rig is set up with three nozzles directed to the band on each row. Your sprayer has been thoroughly cleaned, and the nozzles are uniform in output, after replacing those out of range.

- Using the chart again, the distance to travel for a **38 inch row** is **107 feet**. You measure your course drive it several times. Let's assume it took an average of 18 seconds.
- Park the sprayer and at the same engine speed and your desired pressure, collect the output of each of the three nozzles for 18 seconds. If the *combined* total output of the three-nozzle band cluster is, for example, 25 ounces, the sprayer is applying **25 gallons per acre**.
- Now, let's say your sprayer has a **200 gallon tank**. The broadcast rate for Staple is **2.2 fl oz/A**, and **nonionic surfactant** is to be added at **1 qt/100 gal. of spray mix**.

$$[200 \text{ gal tank} \div 25 \text{ GPA}] = 8 \text{ acres covered per tank}$$

- Now, reduce the rate for a 19 inch band:

$$[38 \text{ inch broadcast} \div 19 \text{ inch band}] \times 2.2 \text{ oz/A Staple product} = 1.1 \text{ oz/A Staple}$$

$$\text{Therefore: } 8 \text{ acres} \times 1.1 \text{ fl oz/A} = 8.8 \text{ fl oz Staple needed per tank}$$

$$\text{Surfactant needed per tank is, } 200 \text{ gallon tank} \times (1 \text{ qt surfactant}/100 \text{ gallon spray}) = 2 \text{ qts. nonionic surfactant per tank}$$

Note: the surfactant rate in this example is calculated based on *amount per volume of spray mix*, rather than amount per acre, it is calculated the same as for broadcast applications.

Post-Directed and Hood Applications:

You plan to use a hooded sprayer to make post-directed and hooded applications in your **38 inch row** cotton. Given, the gallon per acre (GPA) under the hood needs to match as close as possible to the GPA of your post-directed band. The hooded rig is set up to use **two nozzles** post-directing on a **13 inch band** and has **three nozzles** under the hood spraying a **25 inch band**.

Scenario 1: One pump applying one tank mix.

1. The distance to travel for a **38 inch row** is **107 feet (Table 1)**. You measure your course and drive it. Let's assume it took an average of **18 seconds**.
2. Park the sprayer and at the same engine speed and at the desired pressure and collect the output of the **three nozzles** under the hood for 18 seconds. Combine the output of the three nozzles and measure. The combined total, *for example* **20 ounces**, equals the application rate in GPA. In this case your hoods are applying at **20 GPA**.
3. Next, with your sprayer running at the same engine speed and pressure, collect the output of the **two post-directing nozzles**. Combine the output from these **two nozzles** and measure. The combined total, *for example* **13 ounces**, equals the application rate in GPA. In this case the post directing nozzles are applying at **13 GPA**.
4. Remember, you want the application rate *to be the same for both the post-directed and hooded application*. To accomplish this, decide which application rate fits your needs. In this example, we will assume that **13 GPA post-directed** is ideal. To get your hooded application to be **13 GPA**, instead of **20 GPA**, *reduce the size of the spray tips* under the hood and re-run the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

Scenario 2. Two (2) pumps applying from separate tanks.

1. From **Table 1**, the distance to travel for a **38 inch row** is **107 feet**. Your course is measured, and you drive it. Let's assume it took **18 seconds**.
2. Park the sprayer and at the same engine speed and desired pressure, collect the output of the **three nozzles** under the hood for **18 seconds**. Combine the output of the three nozzles and measure. The combined total, *for example* **18 ounces**, equals the application rate in GPA. In this case the hoods are applying at **18 GPA**.
3. Next, with the sprayer running at the same engine speed and desired pressure, collect the output of the **two post-directing nozzles**. Combine the output from these two nozzles and measure. The combined total, *for example* **15 ounces**, equals the application rate in GPA. In this case the post directing nozzles are applying at **15 GPA**.
4. Remember, you want the *application rate to be the same for both the post-directed and hooded application*. To accomplish this, decide which application rate fits your needs. In this example, we will assume that **15 GPA post-directed** is ideal. To get your hooded application to be 15 GPA instead of 18 GPA, you have two (2) options.

a) First *reduce the pressure for the pump* applying under the hood. *Caution:* Be sure that after reducing the pressure the spray tip *still produces an acceptable spray pattern*. Repeat the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

b) The second option is to *change to a smaller spray tip size under the hood* to reduce the application rate to 15 GPA. Repeat the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

SPRAY DRIFT MANAGEMENT

Mike Marshall, Extension Weed Specialist

A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature, and relative humidity) and method of application (e.g., ground, aerial, and airblast) can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying pesticides.

- ✓ READ the PESTICIDE LABEL for guidelines on preventing drift!
- ✓ Select a nozzle that maximizes product performance (i.e., small droplets for contact herbicides, such as paraquat) and minimizes spray drift potential (i.e., ultra-coarse droplets for auxin type herbicides, such as dicamba).
- ✓ Use the recommended spray pressure according to the nozzle manufacturer guidelines.
- ✓ Don't apply pesticides under windy or gusty conditions (do not spray when wind speeds are greater than 15 mph).
- ✓ Use the minimum boom height according to nozzle manufacturers recommendations. Spray drift increases as boom height increases.
- ✓ Use a hand-held anemometer to determine wind speed and direction at the application site.
- ✓ Don't spray when the wind is less than 3 mph to avoid spraying in temperature inversions where vertical mixing of the air is limited.
- ✓ Maintain required buffer zones according to the label instructions.
- ✓ Utilize drift control/reduction agents in your tank mix.
- ✓ Before spraying, document your surroundings, especially the location, direction, and distance of susceptible crops and sensitive sites relative to the treated site.

As an applicator, **YOU** are responsible for where the chemicals from your spray rig go!

SPRAYER CLEANOUT

Mike Marshall, Extension Weed Specialist

Residues of pesticide solutions left in sprayer tank or lines can cause severe damage later if applied to susceptible crops. For example, traces of growth regulator type herbicides used for burndown and/or pasture weed control, including 2,4-D amine/ester, can create serious problems if accidentally applied to susceptible broadleaf crops such as tobacco, cotton, tomatoes fruiting vegetables, and other susceptible plants. Most of these herbicides, particularly the oil-based formulations of 2,4-D and Crossbow, are difficult to thoroughly wash out of a sprayer. *Therefore, using a dedicated sprayer for application of these growth regulator type herbicides is often recommended.*

The sulfonylureas and imidazolinones herbicides, such as Accent, Classic, Exceed, Staple, and Scepter, have also created sprayer cleaning challenges. These herbicides have a high unit activity (a small amount of product that is left in the sprayer is very active on a per acre basis). Tiny amounts of these dry materials can cause severe damage to non-target, susceptible crops. Some pesticides have specific clean-out instructions outlined on the label and should be followed explicitly to prevent subsequent contamination and injury of the next sensitive crop sprayed by the applicator.

Your tank is only one part of the sprayer. Removing pesticide residue from the tank is relatively quick and easy, but if chemical residues are left in the hoses, strainers, and pump, serious crop damage can still occur. Pesticides can be absorbed into the hoses, especially if left for extended period of time, in addition to polyethylene or fiberglass tanks, where they can remain for a long time. Some dry flowable and wettable powder formulations can precipitate out of solution and accumulate on the bottom of the spray tank and suction line, particularly in sprayers with poor agitation. *The longer a spray mix is left in the system, the greater is the potential contamination problem the next time you use the sprayer.* **Sprayers should be cleaned as soon as possible, and pesticide spray mixtures (especially dry pesticide formulations suspended in water) should never be allowed to sit in the sprayer overnight or longer.**

Personal protective equipment that is recommended on the pesticide label for that product should be worn during clean-up. *Do not clean sprayers near wells, sink*

holes, creeks or other surface water, or near desirable vegetation.

Some pesticide labels recommend a specific sprayer cleaning agent and procedures on the label. For example, Valor SX product label recommends a specific tank mix cleaner product (i.e., Valent tank cleaner) after each use of a flumioxazin containing product. Other pesticides recommend adding household ammonia at 1 gallon per 100 gallons of water. Ammonia is also useful for removing 2,4-D ester residues left in the sprayer because ammonia changes the less soluble ester into a more highly water-soluble ammonium salt of 2,4-D. Many commercial tank cleaners are available and most do an excellent job, if properly used, of cleaning a sprayer tank and components. They are just like ammonia in that plenty of water and proper procedure are required.

Sprayer cleaning procedure for pesticides

1. After spraying, drain the sprayer, boom and lines in an area appropriate for rinsate disposal. Do not allow the spray solution to remain in spray boom lines overnight prior to flushing the system.
2. Flush the tank, hoses, boom, and nozzles with clean water. Open boom ends and flush if appropriate.
3. Inspect and clean all strainers, screens, and filters.
4. Prepare a commercial detergent, sprayer cleaner, or ammonia according to the manufacturer's directions.
5. Take care to wash all parts of the tank including the inside top surface. Start agitation in the sprayer and thoroughly recirculate the cleaning solution for at least 15 minutes. All visible deposits must be removed from the spraying system.
6. Flush hoses, spray lines, and nozzles for at least 1 minute with the cleaning solution.
7. Repeat the previous steps for 2 additional times to accomplish an effective triple rinse.
8. Remove nozzles, screens, and strainers and clean separately in the cleaning solution after completing the above procedures. Drain the sump, filter, and lines.
9. Rinse the complete system with clean water.
10. Clean and wash off the outside of the entire sprayer and boom.
11. Dispose of rinsate from all the steps above in an appropriate manner that complies with all applicable local, state, and federal requirements, laws, and regulations.

Sprayer cleaning procedure for Xtendimax, Engenia, Tavium, Enlist One, Enlist Duo herbicides:

1. Completely drain the spray system including pumps, lines, and spray boom for at least 5 minutes.
2. Fill the spray tank with clean water to at least 10% of the total tank volume and circulate the solution through the entire system so that all internal surfaces are contacted for at least 15 minutes to complete the first rinse of the application equipment. Spray the solution from the tank out through the boom.
3. Completely drain the spray system including pumps, lines, and spray boom for at least 5 minutes; remove and clean filters and strainers.
4. During the second rinse, fill the container with clean water to at least 10% of the total tank volume. The addition of tank cleaning agents may be used at the manufacturer's recommended rates. Circulate the solution through the entire system for at least 15 to 20 minutes. Let the solution stand for several hours or overnight. Spray the solution out of the tank through the boom.
5. Completely drain the spray system including pumps, lines, and spray boom for at least 5 minutes.
6. Fill the spray tank with clean water to at least 10% of the total tank volume and circulate the solution through the entire system so that all internal surfaces are contacted for at least 15 minutes to complete the third rinse of the application equipment. Spray the solution out of the tank through the boom.
7. Completely drain the spray system, remove nozzles tips and strainers and clean them separately.
8. Clean and wash off the outside of the entire sprayer and boom.
9. Dispose of rinsate from all the steps above in an appropriate manner that complies with all applicable local, state, and federal requirements, laws, and regulations.

Important: Remember to clean all other associated application equipment. Personal protective equipment, as prescribed on the label, should be worn during the clean-up process and do not clean sprayers near wells, sink holes, creeks or other surface water, or near desirable vegetation.

PESTICIDE SPRAY ADDITIVES

Mike Marshall, Extension Weed Specialist

Spray Additives

A spray additive is any substance added to an herbicide tank mix to enhance performance. Adjuvants are classified based on their use rather than chemistry.

Adjuvants types include surfactants, emulsifiers, wetting agents, stickers, de-foamers, compatibility agents, crop oils, and drift control agents.

Types of Spray Additives:

Surfactants (surface-active-agent): Are used to improve emulsifying, dispersing, spreading, wetting, or other surface modifying properties of a liquid. Three types of surfactants are emulsifiers, wetting agents, stickers. Choose a non-ionic surfactant based on composition. A surfactant with 80% or greater active ingredient is a desirable choice.

Emulsifiers: Substances that promote suspension of one liquid in another. They are typically used to disperse oil in water. These are usually contained in the herbicide package formulation.

Wetting agents: Reduce interfacial tensions between surfaces that would normally repel each other. These allow a spray solution to spread and adhere better to waxy cuticles of plants. Nonionic surfactants (NIS) are the type usually added to a spray tank. They are good dispersing agents, stable in cold water, and have low toxicity to plants and animals.

Stickers: Adjuvants that promote adherence of herbicides to the plant foliage. They reduce runoff potential during application and wash off by rainfall. These are usually blended with wetting agents to provide better coverage and are called spreader-stickers.

Antifoaming Agents: These materials reduce foaming tendency of some pesticides in a sprayer system so that pumps and nozzles can operate effectively.

Compatibility Agents: Aid in holding herbicides in solution when mixed with pesticides or fertilizers.

Crop Oils: These are non-phytotoxic light petroleum or vegetable oils that contain surfactants. Crops oils are used much like a surfactant; but they tend to temporarily burn crop foliage. Choose crop oil which contains 80% or greater oil, and the rest as surfactants or emulsifiers.

Drift Control Agents: Materials used to reduce the number of fine particles in the spray pattern which could move from the application site and result in drift damage.

PESTICIDE STORAGE AND DISPOSAL

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Store pesticides in a cool and dry place, preferably in a locked, detached structure, in their original container with intact and readable labels. Also, pesticides should not be stored with seed, gasoline, fuels, and other flammable solvents.

The proper container rinse procedure requires that you plan accordingly:

- ✓ Read and follow label directions!
- ✓ Wear the required protective clothing and equipment.
- ✓ Rinse containers immediately after emptying because pesticides will typically dry or solidify quickly and the residues will become difficult to remove.
- ✓ Consider the volume of the rinsate when filling the sprayer tank. Leave enough room in the sprayer tank to accommodate the rinsate before filling the tank.
- ✓ Use a back-flow preventer on the hose when filling the sprayer tank and rinsing the container.

There are two acceptable ways to rinse empty pesticide containers:

- 1) **Triple-rinsing or**
- 2) **Pressure-rinsing** (jet-rinsing) using an EPA approved device specifically manufactured to wash container interiors.

Triple-rinse container instructions:

- ✓ Allow empty pesticide container to drain into the sprayer tank for at least 30 seconds.
- ✓ Fill container one-quarter full of clean water or appropriate spray rinse diluent. Replace cap securely and roll, swirl and shake the contents vigorously for at least one full minute to rinse all surfaces!
- ✓ Remove container cap and empty rinsate into the spray tank. Allow the container to drain for at least 30 seconds.
- ✓ Repeat the fill, shake and drain procedure two (2) more times, using clean water.
- ✓ Properly dispose of the rinsed containers as soon as possible. Dispose of caps with the containers unless recycling.
- ✓ Plastic and plastic-lined bags can be triple-rinsed. For paper and fiber bags and similar containers, completely empty the contents into the tank. Open both ends of the container to remove any remaining pesticide and to prevent reuse.

How to pressure-rinse containers:

- ✓ Allow the empty pesticide container to drain into the sprayer tank for at least 30 seconds.
- ✓ Hold the container upside down over the sprayer tank opening so that rinsate will run into the sprayer tank. For ease and safety, puncture through the bottom of metal containers and through the side of plastic containers with appropriate tool or pressure-rinsing nozzle-follow specific manufacturer directions.
- ✓ Thoroughly rinse the empty container for the time interval recommended by the pressure-rinse nozzle manufacturer, but no less than 30 seconds, using at least 40 psi water pressure.
- ✓ Properly dispose of your rinsed containers as soon as possible. Dispose of caps with containers, unless recycling. Caps are not recyclable.

RESISTANCE MANAGEMENT

Mike Marshall, Extension Weed Specialist

Repeated applications or use of pesticides with the same mode-of-action can lead to the selection of individuals or biotypes that are resistant to that pesticide. Applicators are encouraged to select and use products with differing modes of action within a crop year.

Resistance may be defined as “a heritable change in the sensitivity of a pest population that is reflected in the repeated failure of a product to achieve the expected level of control when used according to the label recommendation for that pest species”.

Resistance arises through the over-use and/or misuse of a pesticide against a pest and results in the selection of resistant biotypes and the resulting populations that are resistant to that pesticide and its mode of action (MOA). Pesticides do NOT change the DNA of the pest and cause resistance.

In most cases, not only does resistance render the selecting compound much less effective but may also confer cross-resistance to other chemically related pesticides. Cross-resistance occurs when resistance to one pesticide confers resistance to another pesticide, even where the pest has *not* been exposed to the latter product.

The objective of successful Pesticide Resistance Management is to delay the evolution of pest resistance to pesticides, or to help regain susceptibility in pest populations in which resistance has already arisen.

Because many pest populations are usually present in large numbers and quickly reproduce (especially mites,

many insects and most plant pathogens), there is always a risk that pesticide resistance may evolve quickly, especially when pesticide are misused or over-used.

If you obtain less control of a pest with a given pesticide than you are accustomed to, or believe is reasonable to expect, *first* check to be sure that you applied the pesticide properly according to the label instructions. If you made your application properly, next consider if there were any extreme environmental conditions – very hot, very cool, heavy rain, etc. If none of these conditions existed, or are not believed to influence the product’s performance, then pesticide resistance is a possibility.

Doing everything you can to delay pesticide resistance is important for several important reasons. Currently, the rate at which new pesticide modes-of-action are being developed is a slow and expensive process. This lack of new alternatives gives us few choices when it comes to switching to a different pesticide when resistance arises. For instance, there have not been any significant new modes-of-action for herbicides in about three decades. While new herbicide products are coming onto the market, often in conjunction with herbicide resistant crop varieties, the herbicides themselves are some of the oldest herbicides we have, for instance 2,4-D.

There are several ways to delay pesticide resistance. The best is to use Integrated Pest Management (IPM) and to use economic injury thresholds to determine when to apply a pesticide(s). Other methods include rotating crops to prevent buildup of the same pest populations over time, to use the lowest effective rate or rate recommended by the pesticide label or a knowledgeable expert and make spot or perimeter applications on small or defined pest populations. When using pesticides, rotate pesticide modes of action by rotating pesticide chemical families.

To help growers and others combat pesticide resistance several national and international resistance action committees have been formed by the pesticide industry and others to address the problem of pesticide resistance. These committees are based on the different major pesticide groups. So, for herbicides there is an Herbicide Resistance Action Committee (HRAC), Insecticide Resistance Action Committee (IRAC) for insecticides, a the Fungicide Resistance Action Committee (FRAC) for fungicides, and so on. These committees have studied the modes of action of the respective pesticide families and developed a system to help growers and others better select pesticides from different pesticide chemical families to allow users to effectively rotate the modes of action and thus combat

pesticide resistance in their pests. This information is now appearing on pesticide labels. In addition to the system developed by the respective Action Resistance Committees, many pesticide manufacturers are beginning to supply information on resistance management on their labels in sections titled “Resistance Management”. To date, generic pesticide products tend not to have as much information as brand name pesticide products.

When you want to rotate modes of action against your pests, first make sure that whatever pesticide you select is labeled for your intended use. Next, look for a pesticide group number on the label, or a statement indicating the pesticide group. Using these pesticide group numbers, you do not have to know or understand the complex modes of action of these chemicals, you should select a product(s) with a *different* group number that is labeled for your pest management need. Examples of group numbers when they appear on pesticide labels are usually in the upper right-hand corner of the label, look like this:

GROUP	4A	INSECTICIDE
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GROUP	3	HERBICIDE
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GROUP	11	FUNGICIDE
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PESTICIDE APPLICATION RECORDKEEPING

Katie Moore, Pesticide Safety Coordinator

Certified Private Applicators are required to keep records of their applications of Restricted Use Pesticides (RUPs). This federal requirement is administered by the USDA and in South Carolina is enforced by the Department of Pesticide Regulation.

The information – “data elements” – required to be kept are minimal. Private Applicators will likely want to record more information on their applications, all their applications, to help with their present and future pest management efforts. Good records help you troubleshoot application problems and duplicate pest management successes.

The data elements required to be kept on each RUP application are:

- The brand/product/trade name of the pesticide
- EPA product Registration Number
- Total amount of pesticide *product* applied
- Size of area or the number of units treated
- Crop or Site applied to
- Actual* location of the application
- Date of application: Month, Day, Year
- Certified applicator name and license number

Records must be made within 14 days of each application of a RUP. Records must be maintained for a minimum of two (2) years from the date of the application.

Spot treatments: Spot applications are small applications which total less than 1/10th of an acre, and

they are made in the same day. Spot applications do *not* apply to nurseries or greenhouses.

For Spot treatments, you must record:

- Date of application - month, day, year
- Brand or product name
- EPA Registration Number
- Total amount of pesticide applied
- Location of the pesticide application, designated as “spot application” with a brief description.

Record keeping tips:

Record all three (3) identifiers for your RUP.

- **Product or Brand (Trade) name**
- **Common chemical name of the active ingredients**
- **The EPA Registration No.**

Keep additional information that will help YOU better achieve YOUR pest and pesticide management objectives. For instance, amount of water used, spray pump pressure, boom height, nozzle spacing tip used, tractor speed or rpms, other equipment settings, and weather information such as temperature, rainfall the 24 hours before and 24 hours after the application, wind speed (recorded at the site of the application at the time of the application), notes on any application problems, and any other information that would be useful to *you*.

You are required to keep records of any worker or handler pesticide safety training you conduct or have conducted for your ag employees.

DICAMBA (DT) CROPS RECORD KEEPING REQUIREMENTS

Mike Marshall, Extension Weed Specialist

Applicators must keep the following records for a period of two years, records must be generated within 72 hours of application of a DICAMBA product in a DT crop, and a record must be kept for every individual application. Records must be made available to State Pesticide Control Official(s), USDA, and EPA upon request.

1. All items required by 7 CFR Part 110 (Recordkeeping on Restricted Use Pesticides by Certified Applicators) including:

- a. Brand or product name
- b. EPA registration number
- c. Total amount applied
- d. Application month, day, and year
- e. Location of the application
- f. Crop, commodity, stored product, or site of application
- g. Size of treated area
- h. Name of certified applicator
- i. Certification number of certified applicator

2. Training*: Completion date and provider of required training and proof of completion.

3. Receipts of Product Purchase: Receipts or copies for the purchase of this product.

4. Product Label: A copy of the product label(s), and any state special local needs label that supplements the product label.

5. Sensitive Areas and Certain Plants Awareness:

- j. Document that a sensitive crop registry was consulted. At minimum, documentation must include name of sensitive crop registry and date it was consulted.
- k. Record of a survey of adjacent areas documenting the sensitive crops and/or certain plants (as defined by the "Adjacent sensitive Crops and Certain Plants" section of the label) surrounding the field prior to application. At minimum, records should include documentation of adjacent sensitive crops and/or certain plants and the date survey was conducted.

6. Buffer Requirement: Record of the buffer distance implemented as directed in the "Spray Drift

Management" and "Optional Use of Drift Reduction Technology" sections of the product label.

7. Start and Finish Times: Record of the time when the application started and finished.

8. Application Timing: Record of the type of application (i.e., preemergence, postemergence) and the number of days after planting if postemergence.

9. Air Temperature: Record of the air temperature in degree Fahrenheit at the start and completion of each application.

10. Wind Speed and Direction: Record of the wind speed and direction (the direction from which the wind is blowing) at boom height at the start and completion of each application.

11. Nozzle and Pressure: Record of the spray nozzle manufacturer/brand, type, orifice size, and operating pressure used during each application.

12. Tank Mix Products: Record of the brand names and EPA registration numbers (if applicable) for all products that were tank mixed with this product for each application as well as a record of the volume added to each tank before application.

13. Mandatory Volatility and Drift Reduction Adjuvants: Receipts or copies of purchase of an approved volatility reduction adjuvant, as well as a record of the volume added to the tank before application. Receipts or copies for the purchase of any approved DRA and a record of the volume added to the tank before application.

14. Spray System Cleanout: At minimum, records must include confirmation that the spray system was cleaned before using this product and that the post-application cleanout was completed in accordance to the "Proper Spray System Equipment Cleanout" section of the label.

***Training:** Prior to applying the dicamba product, ALL CERTIFIED APPLICATORS must complete dicamba training course provided by Clemson University Extension or online training course provided by the registrants. Dicamba application recordkeeping forms can be downloaded from the following registrants websites.

HONEYBEE STEWARDSHIP

Benjamin Powell, Extension Apiculturist

Honeybees are our most beneficial insect. The estimated value of honeybee pollination in the US is \$19 billion. Many commercially grown crops in South Carolina are heavily dependent on honeybees for good pollination. Annual farm cash receipts of crops harvested in South Carolina that are dependent on honeybees for pollination are estimated at \$25 million. This does not include homegrown vegetables and fruits and plants for wildlife that are highly dependent on bees for pollination. Some of the fruits and vegetables that are highly dependent on bees for pollination are apples, cantaloupes, cucumbers, squash, strawberries, and watermelon.

Use integrated pest management recommendations whenever possible to minimize harmful effects to our beneficial insects. Many pesticides are extremely toxic to bees. Those pesticides that are toxic or highly toxic to bees will have a bee protection warning statement on the label. The pesticide applicator should always review the product label directions carefully before each use and follow the guidelines to protect our pollinators, which include native bees as well as honeybees. Keep in mind that even herbicides and fungicides can have negative effects on insect pollinators and can have synergistic effects when combined with other pesticides.

It is not only the formulation of the chemical pesticide that is important, but applicators must also be aware of the proper dose. Pesticides should be used only when necessary, especially if flowering plants are present or nearby and are attractive to bees. Select the least toxic pesticide to get the job done when possible and use the least hazardous method of application. Granular pesticide formulations are safest. Directed sprays applied with ground equipment are the next safest method for applying pesticides to protect bees. Aerially applied dusts or sprays are the most likely to contact bees and cause problems. Apply pesticides when air is calm to reduce drift into areas where bees may be foraging or nesting. If a pesticide application is necessary, apply in the evening when bees are not present. If managed bee colonies are present, it is best to give the beekeeper plenty of notice (3-4 days if possible) of your intentions. The beekeeper has the option to relocate their beehives if adjacent fields are to be sprayed. If there are many beehives or hives that cannot be moved on short notice, the beekeeper may cover their beehives with wet burlap for no longer than 2 days. It will be necessary for the beekeeper to spray covered hives with water and keep the burlap wet, especially in hot weather.

Beekeepers are advised to cooperate with growers in the area to help protect bees and are encouraged to have a contract with the landowner. Beekeepers should scout the area before bee colony placement to gain a good understanding of local farming practices, especially the use of highly toxic pesticides. Beekeepers are ill advised to place their colonies in high pest density areas, as they may require multiple pesticide applications. An example is cotton-growing areas where various pests are expected. Beekeepers should post their name and contact information in the apiary or on colonies for identification purposes. Information on the relative toxicities and environmental impacts of specific pesticides to honeybees and natural enemies may be found at www.ipm.ucdavis.edu and nysipm.cornell.edu/eiq.

Mosquito abatement programs should take into consideration the protection of our insect pollinators. Many of the pesticides used to kill mosquitoes will also kill honeybees. Beekeepers are urged to contact county officials who manage mosquito abatement programs to inform them of the location of their apiaries, so their honeybees can be protected.

Clemson University has started a bee stewardship program to facilitate communication between beekeepers and pesticide applicators and prevent accidental poisoning of honeybees. Beekeepers can map their hive locations and licensed pesticide applicators can access this information when they have an application planned. The applicator can then contact the beekeepers in the area or avoid applying pesticides near the hives. Interested individuals from both sides of this issue are encouraged to read more about the program on the Clemson University Beekeeping website. To sign up, please use the appropriate link below.

For pesticide applicators:

<http://www.kellysolutions.com/clemson/pesticideapplicationnotifications/>

For beekeepers:

<http://www.kellysolutions.com/clemson/beekeepers/>

SITE OF ACTION FOR HERBICIDES

Mike Marshall, Extension Weed Specialist

Site of Action Group	MOA	Chemical Family (ies)	How it kills the plant	Product Examples
1	ACCase Inhibitors	Arloxyphenoxy propionate (FOPS)	Blocks the first step in fatty acid synthesis in grasses, broadleaves are naturally resistant to the fops and dims due to an insensitive ACCase enzyme.	FOPS: Assure II, Fusilade DX
		Cyclohexanedione (DIMS)		DIMS: Select MAX, Poast Plus
2	ALS Inhibitors	Sulfonylurea (SU)	Blocks the production of branched chain amino acids (isoleucine, leucine, and valine) in the plant. Plant death occurs due to insufficient branched chain amino acid levels at the growing points.	SU: Accent, Classic, Beacon
		Imidazonlinone (IMI)		IMI: Cadre, Raptor, Scepter
		Pyrimidines (PM)		PM: Staple
3	Microtubule Protein Inhibitor	Dinitroaniline (DNA)	Interferes with the alignment of the spindle apparatus during mitosis and prevents normal cell division in root tissue.	DNA: Prowl, Treflan, Sonolan
4	Synthetic Auxins	Phenoxy (PX)	Synthetic auxins mimic the natural plant hormone IAA. These herbicides affect cell wall plasticity and nucleic acid metabolism which leads to inhibited cell division and growth in the meristem regions (growing points).	PX: 2,4-D, 2,4-DB
		Benzoic Acid (BA)		BA: Clarity, Banvel, Status
		Carboxylic Acid (CA)		CA: Stinger, Milestone
5	Photosystem II Inhibitor	Triazine (TZ)	PS II herbicides inhibit photosynthesis by binding to the Q _B -binding site on the D1 protein of the photosystem II complex in the chloroplast. It blocks electron flow from Q _A to Q _B and stops CO ₂ fixation and production of ATP and NADPH ₂ which is the energy needed for plant growth and development. Plant death occurs due to excess free radicals destroying cell membranes.	TZ: Atrazine, Simazine, Caparol
		Triazinone (TN)		TN: Sencor
6		Nitriles (NT)		NT: Buctril
7		Benzothiadiazinones (BZ)		BZ: Basagran
			Ureas (UR)	
8	Fatty Acid/Lipid Biosynthesis Inhibitor	Thiocarbamate (TB)	Most susceptible plants fail to emerge from the soil. Germination is not inhibited but growth of grass coleoptiles/broadleaf epicotyls ceases below soil surface	TB: Tillam
9	EPSP Synthase Inhibitor	Glycines (GC)	Glycines inhibit EPSP synthase enzyme which leads to the depletion of the aromatic amino acids tryptophan, tyrosine, and phenylalanine.	GC: Glyphosate

Site of Action Group	MOA	Chemical Family (ies)	How it kills the plant	Product Examples
10	Glutamine Synthesis Inhibitor	Phosphinic Acids (PA)	Phosphinic acids inhibit the activity of glutamine synthetase which converts glutamate and ammonia to glutamine. Accumulation of ammonia to lethal levels destroys plant cells and tissue.	PA: Liberty
12	Phytoene Desaturase Inhibitor	Pyridazinone (PZ)	Pyridazinone inhibits the phytoene desaturase enzyme in the carotenoid biosynthesis pathway	PZ: Solicam, Zorial, Brake
13	DOXP synthase Inhibitor	Isoxazolidinone (IA)	Isoxazolidinone inhibits the 1-deoxy-D-xylulose 5-phosphate synthase (DOXP), a key component in the plastid isoprenoid biosynthesis pathway.	IA: Command
28	HPPD inhibitor	Pyrazole (PA)	Pyrazole and triketones inhibit the 4-hydroxyphenyl-pyruvate dioxygenase (4-HPPD) which affects carotenoid biosynthesis.	PA: Balance, Corvus
		Triketone (TE)	These herbicide families deplete the carotenoid (accessory pigments in photosynthesis) pool that protects chlorophyll in the plant which results in a characteristic bleaching (white) of the plant tissue.	TE: Callisto, Impact, Laudis
14	PPO inhibitors	Diphenylether (DE)	These herbicides inhibit the photoporphyrinogen oxidase (PPO), an enzyme that is responsible for chlorophyll and heme biosynthesis. PPO inhibition leads to accumulation of PPIX (protoporphyrin IX) which creates free radical oxygen in the cell and destroys cell membranes.	DE: Flexstar, Reflex, Blazer, Cobra
		N-phenylphthalimide (NP)		NP: Resource, Valor
		Ary triazinone (AT)		AT: Spartan, Aim, Cadet
15	VLFA inhibitors	Chloroacetamide (CA)	Acetamides are herbicides that inhibit very long chain fatty acid synthesis (VLFA) in shoot tissue during germination of sensitive plants.	CA: Dual Magnum, Intrro, Warrant, Outlook, Parrlay, Zidua
22	Photosystem I Inhibitor	Bipyridyliums (BP)	Bipyridyliums are herbicides that capture electrons from photosystem I complex in the chloroplast and are reduced to form herbicide free radicals. These free radicals destroy cell membranes.	BP: Gramoxone, Reward

CROP REPLANT GUIDELINES FOLLOWING HERBICIDE APPLICATION

Mike Marshall, Extension Weed Specialist

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
<i>M = months, D = days, Spring = The spring following application, --- = no information on label</i>								
Acuron	0 D	10 M	10 M	10 M	10 M	18 M	18 M	4 M
Accent/Q	0 D	10 M	10 M	10 M	15 D	10 M	10 M	4 M
Aim	0 D	0 D	0 D	0 D	0 D	0 D	12 M	0 D
Anthem	0 D	4 M	18 M	4 M	0 D	4 M	18 M	4 M
Anthem ATZ	0 D	Spring	Spring	Spring	Spring	Spring	Spring	Spring
Anthem FLEXX								
1.82 oz/A	0 D	0 D	6 M	4 M	0 D	4 M	18 M	0 D
3.64 oz/A	0 D	2 M	6 M	4 M	0 D	4 M	18 M	1 M
5.46 oz/A	0 D	4 M	10 M	4 M	0 D	4 M	18 M	4 M
6.38 oz/A	0 D	4 M	10 M	4 M	4 M	4 M	18 M	6 M
7.28 oz/A	0 D	4 M	12 M	4 M	4 M	4 M	18 M	6 M
Armezon	0 D	9 M	9 M	9 M	9 M	9 M	18 M	3 M
Armezon PRO	0 D	9 M	9 M	9 M	9 M	9 M	18 M	4 M
Assure II	120 D	0 D	120 D	120 D	0 D	0 D	120 D	120 D
Atrazine	0 D	Spring	0 D	Spring	Spring	Spring	Spring	4 M
Authority MAXX	10 M	12 M	10 M	9 M	0 D	18 M	10 M	4 M
Authority MTZ	10/4 ¹ M	12 M	18/12 ² M	12 M	0 D	12 M	12 M	4 M
Authority Supreme								
≤3.27 fl. oz/A	4 M	12 M	10 M	4 M	0 D	0 D	18 M	4 M
6.54 fl. oz/A	4 M	12 M	10 M	4 M	0 D	0 D	18 M	4 M
9.8 fl. oz/A	4 M	12 M	10 M	4 M	0 D	0 D	18 M	4 M
13.07 fl. oz/A	4 M	12 M	12 M	4 M	4 M	2 M	18 M	6 M
16.4 fl. oz/A	4 M	18 M	12 M	4 M	4 M	4 M	18 M	6 M
Axial XL	90 D	90 D	90 D	90 D	90 D	90 D	90 D	0 D
Axiom	0 D	8 M	12 M	18 M	0 D	18 M	18 M	7 D/4 M ³
Balan	---	---	---	---	---	---	---	---
Balance Flexx	0 D	10 M	6 M	11 M	6 M	6 M	12 M	4 M
Banvel	120 D	120 D	120 D	120 D	120 D	120 D	120 D	7.5 D
Basagran	---	---	---	---	---	---	---	---
Beacon	14 D	8 M	8 M	8 M	8 M	8 M	8 M	3 M
Beyond	0 D ⁴ /8.5 M ⁵	9 M	9 M	9 M	0 D	0 D ⁴ /9 M ⁵	9 M	0 D ⁴ /3 M ⁵
Bicep II Magnum	0 D	Spring	0 D	Spring	Spring	Spring	Spring	Spring
Boundary	4 M	8 M	12 M	12 M	12 M	12 M	12 M	4.5 M
Brake								
12-16 fl oz/A	10 M	0 D	10 M	0 D	2 M	18 M	18 M	8 M
16-21 fl oz/A	12 M	0 D	12 M	8 M	4 M	18 M	18 M	8 M
21-32 fl oz/A	18 M	0 D	18 M	8 M	12 M	18 M	18 M	12 M
Breakfree	0 D	Spring	Spring	Spring	Spring	Spring	Spring	4 M
Breakfree ATZ	0 D	Spring	Spring	15 M	Spring	15 M	15 M	15 M
Cadet	0 D	Spring	Spring	Spring	0 D	Spring	Spring	Spring
Cadre	9 M	18 M	18 M	0 D	9 M	26 M	9 M	4 M
Callisto	0 D	10 M	0 D	10 M	10 M	10 M	10 M	120 D
Canopy	10 M	10 M	10 M	8 M	0 D	18 M	10 M	4 M
Caparol	Spring	Spring	Spring	Spring	Spring	Spring	Spring	Spring

¹Field corn may be planted 4 months after Authority MTZ was applied at 14 oz/A or less; ²Grain sorghum may be planted 12 months after Authority MTZ was applied at 20 oz/A or less; ³Rotation is 7 days when rates of 10 oz/A of Axiom or less have been applied; otherwise, wait 4 months to plant wheat; ⁴Clearfield corn, sunflower, and wheat; ⁵Non-Clearfield corn, sunflower, and wheat.

Crop Replant and Rotation Restrictions Guide for Herbicides (cont)

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
<i>M = months, D = days, Spring = The spring following application, --- = no information on label</i>								
Capreno	0 D	10 M	10 M	11 M	10 M	18 M	12 M	4 M
Cinch	0 D	0 D	0 D	0 D	0 D	0 D	Spring	4.5 M
Cinch ATZ	0 D	Spring	0 D	Spring	Spring	Spring	Spring	Spring
Clarity								
8 fl oz/A	0 D	21 D	15 D	120 D	14 D	120 D	120 D	15 D
16 fl oz/A	0 D	120 D	120 D	120 D	28 D	120 D	120 D	30 D
24 fl oz/A	120 D	120 D	120 D	120 D	120 D	120 D	120 D	45 D
25-64 fl oz/A	120 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D
Classic	8 M	7 M	9 M	6 M	0 D	18 M	9 M	3 M
Cobra	None	None	None	None	None	None	None	None
Command	9 M	0 D	9 M	9 M	0 D	12 M	0 D	12 M
Corvus	0 D	10 M	17 M	11 M	9 M	17 M	12 M	4 M
Cotoran	8 M	0 D	9 M	8 M	9 M	12 M	12 M	3 M
Crusher	0 D	1 M	10 M	1.5 M	1 M	10 M	10 M	3 M
Dawn	10 M	0 D	18 M	10 M	0 D	18 M	18 M	4 M
Define	0 D	4 M	12 M	12 M	0 D	12 M	12 M	12 M
Degree	0 D	Spring	0 D	Spring	0 D	Spring	0 D	Spring
Degree Xtra	0 D	Spring	0 D	Spring	Spring	Spring	Spring	4 M
Devrinol	12 M	12 M	12 M	12 M	12 M	12 M	0 D	180 D
Direx/Diuron								
USE PATTERN 1 ¹	4 M	4 M	4 M	4 M	4 M	4 M	4 M	4 M
USE PATTERN 2 ²	Spring	Spring	Spring	12 M	12 M	12 M	12 M	12 M
LAYBY	Spring	Spring	Spring	12 M	12 M	12 M	12 M	12 M
Distinct	30 D	30 D	30 D	120 D	30 D	120 D	120 D	30 D
Dual 8E	12 M	12 M	12 M	12 M	12 M	12 M	Spring	4.5 M
Dual Magnum	12 M	12 M	12 M	12 M	12 M	12 M	Spring	4.5 M
Dual II Magnum	12 M	12 M	12 M	12 M	12 M	12 M	Spring	4.5 M
Engenia								
≤6.4 fl oz/A	0 D	0 ³ /21 D ⁴	14 D	120 D	0 ³ /14 D ⁴	120 D	120 D	14 D
9.6 fl oz/A	0 D	0 ³ /28 D ⁴	21 D	120 D	0 ³ /21 D ⁴	120 D	120 D	21 D
12.8 fl oz/A	0 D	0 ³ /42 D ⁴	28 D	120 D	0 ³ /28 D ⁴	120 D	120 D	28 D
Enlist Duo	0 D/7-14 D	0 D/30 D	---	---	0 D/30 D	---	---	---
Enlist One	0 D/7-14 D	0 D/30 D	---	---	0 D/30 D	---	---	---
Envive	8 M	10 M	12 M	8 M	0 D	18 M	10 M	4 M
Eptam	---	---	---	---	---	---	---	---
EverpreX	12 M	12 M	12 M	12 M	12 M	12 M	Spring	4.5 M
Envoke	7 M	7 M	7 M	7 M	7 M	18 M	7 M	3 M
ET/ET X	0 D	0 D	30 D	30 D	0 D	30 D	30 D	0 D
Evik	11 M	11 M	11 M	11 M	11 M	11 M	11 M	3 M
Expert	0 D	Spring	0 D	Spring	Spring	Spring	Spring	Spring
Express	14 D	14 D	14 D	45 D	14 D	45 D	45 D	0 D
Fierce								
3.0 oz/A	7 D ⁵ /1 M ⁶	30 D ⁵ /45 D ⁶	18 M	4 M	0 D	4 M	18 M	30 D
3.75 oz/A	30 D	2 M	18 M	4 M	0 D	4 M	18 M	2 M
Fierce EZ								
6 fl. oz/A	7 D	1 M	18 M	4 M	0 D	4 M	12 M	1 M
7.5 fl. oz/A	1 M	2 M	18 M	4 M	0 D	4 M	12 M	2 M
9 fl. oz/A	1 M	2 M	18 M	4 M	0 D	4 M	12 M	2 M

¹DIREX USE PATTERN 1 = Banded DIREX Preemergence or Postemergence application only; ²DIREX USE PATTERN 2 = Banded DIREX Preemergence and Postemergence or Broadcast DIREX Preemergence (and preplant) or Broadcast DIREX preemergence plus Banded DIREX postemergence applications; ³DT cotton/soybean varieties; ⁴non-DT cotton/soybean varieties; ⁵Reduced tillage production; ⁶Conventional tillage production.

Crop Replant and Rotation Restrictions Guide for Herbicides (cont)

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
<i>M = months, D = days, Spring = The spring following application, --- = no information on label</i>								
Fierce XLT	18 M	18 M	18 M	18 M	0D	18 M	18 M	4 M
Finesse	18 M	18 M	4 M	---	18 M/6 M ¹ /4M ²	---	---	0 D
Firestorm	0 D	0 D	0 D	0 D	0 D	0 D	0 D	0 D
FirstRate	9 M	9 M	9 M	9 M	0 D	30 M	18 M	4 M
FirstShot	14 D	14 D	14 D	45 D	7 D	45 D	45 D	0 D
Flexstar	10 M	0 D	10 M	10 M	0 D	18 M	18 M	4 M
Flexstar GT/GT 3.5	10 M	0 D	10 M	10 M	0 D	18 M	18 M	4 M
FulTime NXT	0 D	Spring	Spring	Spring	Spring	Spring	Spring	4 M
Fusilade DX	60 D	0 D	60 D	0 D	0 D	0 D	0 D	60 D
Fusion	60 D	0 D	60 D	0 D	0 D	0 D	0 D	60 D
Gangster	9 M	9 M	9 M	9 M	0 D	30 M	30 M	3 M
Glyphosate	0 D	0 D	0 D	0 D	0 D	0 D	1 M	0 D
Goal/GoalTender	10 M	7 D	10 M	60 D	7 D	60 D	60 D	10 M
Gramoxone 2/3S	0 D	0 D	0 D	0 D	0 D	0 D	0 D	0 D
Guardman Max	0 D	Spring	0 D	Spring	Spring	Spring	24 M	Spring
Halex GT	0 D	10 M	0 D	10 M	10 M	10 M	10 M	120 D
Harmony Extra	21 D	21 D	21 D	45 D	14 D	45 D	45 D	0 D
Harmony GT/XP	0 D	7 D	0 D	45 D	0 D	45 D	45 D	0 D
Harness MAX	0 D	10 M	0 D	10 M	10 M	18 M	18 M	4 M
Hornet WDG	0 D	18 M	12 M	18 M	10.5 M	18 M	18 M	4 M
Huskie	4 M	***3	7 D	***3	4 M	9 M	***3	7 D
Impact	0 D	9 M	9 M	9 M	9 M	9 M	18 M	3 M
ImpactZ	0 D	9 M	9 M	9 M	9 M	9 M	18 M	9 M
Instigate	0 D	10 M	10 M	18 M	10 M	10 M	18 M	4 M
Interline	0 D	0 D	180 D	180 D	0 D	180 D	180 D	70 D
Keystone NXT	0 D	Spring	Spring	Spring	Spring	Spring	Spring	4 M
Kerb 50-W								
1.0 lb/A	---	90 D	---	---	---	---	---	365 D
2.0 lb/A	---	90 D	---	---	---	---	---	365 D
3.0 lb/A	---	120 D	---	---	---	---	---	365 D
Laudis	0 D	10 M	10 M	18 M	8 M	18 M	18 M	4 M
Layby Pro ⁴								
0-0.6 lb ai	4 M	4 M	4 M	4 M	4 M	4 M	4 M	3 M
0.61-1.0 lb ai	4 M	4 M	4 M	8 M	8 M	12 M	8 M	4 M
1.01-1.6 lb ai	4 M	4 M	4 M	12 M	8 M	12 M	8 M	8 M
1.61-2.2 lb ai	8 M	8 M	8 M	12 M	12 M	12 M	12 M	12 M
Leadoff	0 D	1 M	10 M	10 M	1 M	10 M	10 M	3 M
Liberty 280 SL	0 D	0 D	180 D	180 D	0 D	180 D	180 D	70 D
Linex/Lorox	0 D	0 D	0 D	4 M	0 D	4 M	4 M	4 M
Lumax/Lexar	0 D	Spring	Spring	Spring	Spring	18 M	18 M	4.5 M
Maestro	30 D	30 D	30 D	30 D	30 D	30 D	30 D	30 D
Marksman	0 D	Spring	0 D	Spring	Spring	Spring	24 M	10 M
MCPA	None	None	None	None	None	None	None	None
MSMA	None	None	None	None	None	None	None	None
NIC-IT	0 D	10 M	18 M	18 M	15 D	10 M	18 M	8 M
Nimble	21 D	21 D	21 D	45 D	14 D	45 D	45 D	0 D

¹STS soybeans; ²BOLT soybeans; ³A field bioassay must be conducted for crops not listed on the label. To conduct a field bioassay, plant strips of the crop you want to grow the season following herbicide application and monitor for crop safety; ⁴Crop rotation intervals are based on the cumulative amount of DIURON in LAYBY PRO applied to a site in the preceding 12 months.

Crop Replant and Rotation Restrictions Guide for Herbicides (cont)

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
<i>M = months, D = days, Spring = The spring following application, --- = no information on label</i>								
Optill	8.5 M	18 M	18 M	4 M	0-1 M ¹	18 M	9.5 M	4 M
Option	7 D	60 D	60 D	60 D	14 D	60 D	60 D	60 D
Osprey	90 D	90 D	90 D	90 D	90 D	30 D	10 M	7 D
Outlook	0 D	4 M	6 M	6 M	0 D	6 M	6 M	4 M
Parallel PCS	12 M	12 M	12 M	12 M	12 M	12 M	Spring	4.5 M
Parazone	0 D	0 D	0 D	0 D	0 D	0 D	0 D	0 D
Peak	1 M	10 M	1 M	10 M	10 M	22 M	18 M	0 D
Poast/Poast Plus	30 D	0 D	30 D	0 D	0 D	30 D	0 D	30 D
PowerFlex/HL	9 M	9 M	9 M	9 M	5 M	9 M	12 M	30 D
Prefix	10 M	1 M	18 M	10 M	0 M	18 M	18 M	4.5 M
Princep	0 D	Spring	Spring	Spring	Spring	Spring	24 M	Spring
Prowl/Prowl H ₂ O	Spring	0 D	10 M	0 D	0 D	0 D	0 D	4 M
Pursuit	8.5 M	18 M	18 M	0 D	0 D	18 M	9.5 M	4 M
Python	0 D	18 M	12 M	4 M	0 D	18 M	9 M	4 M
Raptor	8.5 M	9 M	9 M	9 M	0 D	9 M	9 M	3 M
Quelex	3 M	3 M	3 M	9 M	3 M	3 M	15 M	0 D
Reflex	10 M	0 D	10 M	10 M	0 D	18 M	18 M	4 M
Realm Q	0 D	10 M	10 M	10 M	10 M	10 M	10 M	4 M
Report Extra	18 M	18 M	18 M	---	6 ² /18 M	---	---	0 D
Resicore	0 D	18 M	10.5 M	18 M	10.5 M	18 M	18 M	4 M
Resolve DF								
1.0 oz/A	0 D	10 M	10 M	18 M	10 M	10 M	18 M	3 M
2.0 oz/A	0 D	10 M	18 M	18 M	10 M	10 M	18 M	3 M
Resolve Q/Q (mp)								
1.25 oz/A	0 D	1 M	10 M	10 M	10 M	10 M	10 M	3 M
2.5 oz/A	0 D	10 M	18 M	18 M	10 M	10 M	18 M	3 M
Resolve SG								
1.0 oz/A	0 D	1 M	10 M	18 M	10 M	10 M	18 M	4 M
2.0 oz/A	0 D	10 M	18 M	18 M	10 M	10 M	18 M	4 M
Resource	0 D	30 D	30 D	30 D	0 D	30 D	30 D	30 D
Revulin Q	0 D	10 M	10 M	10 M	10 M	10 M	10 M	4 M
Reviton								
1.0 oz/A	0 D	7 D	120 D	120 D	7 D	120 D	120 D	0 D
2.0 oz/A	0 D	14 D	150 D	150 D	7 D	150 D	150 D	0 D
3.0 oz/A	0 D	14 D	180 D	180 D	7 D	180 D	180 D	0 D
Rhythm	8 M	0 D	18 M	10 M	0 D	18 M	18 M	4 M
Sandea	1 M	4 M	2 M	6 M	9 M	18 M	36 M	2 M
Scepter	9.5 M	18 M	11 M	11 M	0 D	18 M	9.5 M	3 M
Sentrallas	0 D	120 D	0 D	120 D	120 D	120 D	120 D	0 D
Select/Select MAX	None	None	None	None	None	None	None	None
Sequence	0 D	0 D	0 D	0 D	0 D	Spring	Spring	4.5 M

¹Use the longer interval for coarse textured soils with less than 2.0% organic matter; ²STS soybeans;

Crop Replant and Rotation Restrictions Guide for Herbicides (cont)

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
<i>M = months, D = days, Spring = The spring following application, --- = no information on label</i>								
Sharpen								
1.0 oz/A	0 D	1.5 M	0 D	4 M	0-1M ⁶	4 M	4 M	0 D
2.0 oz/A	0 D	3 M	0 D	5 M	1-2 M ⁶	5 M	5 M	0 D
3.0 oz/A	0 D	4 M	0 D	6 M	2-3 M ⁶	6 M	6 M	0 D
Solicam	24 M	30 D	24 M	30 D	45 D	24 M	24 M	24 M
Solida								
1.0 oz/A	0 D	1 M	10 M	18 M	1 M	10 M	18 M	3 M
2.0 oz/A	0 D	10 M	18 M	18 M	10 M	10 M	18 M	4 M
Sonalan	Spring	Spring	Spring	0 D	0 D	0 D	Spring	Spring
Sonic	10 M	12-18 M ¹	12 M	12 M	0 D	30 M	30 M	4 M
Spartan	10 M	12 M	10 M	12 D	0 D	0 D	0 D	4 M
Spartan Charge	4 M	12 M	10 M	4 M	0 D	0 D	0 D	4 M
Stanza	0 D	18 M	12 M	18 M	10.5 M	18 M	18 M	4 M
Staple LX	10 M	0 D	24 M	10 M	10 M	10 M	10 M	6 M
Starane Ultra	0 D	120 D	0 D	120 D	120 D	120 D	120 D	0 D
Status	7 D	120 D	120 D	120 D	120 D	120 D	120 D	120 D
Steadfast	0 D	10 M	10 M	18 M	15 D	10 M	18 M	4 M
Steadfast Q	0 D	10 M	10 M	18 M	15 D	10 M	18 M	4 M
Steadfast ATZ	10 M	10 M	10 M	18 M	10 M	10 M	18 M	8 M
Stinger	0 D	10.5 M	10.5 M	10.5 M	10.5 M	10.5 M	10.5 M	0 D
Storm	100 D	100 D	100 D	100 D	100 D	100 D	100 D	40 D
Stout	0 D	10 M	10 M	18 M	15 D	10 M	18 M	4 M
Strongarm	18 M	10 M	18 M	0 D	0 D	30 M	18 M	4 M
Suprend	7 M	7 M	7 M	7 M	7 M	18 M	7 M	3 M
SureStart II	0 D	26 M	12 M	26 M	Spring	18 M	26 M	4 M
Surpass	0 D	Spring	0 D	Spring	Spring	Spring	Spring	4 M
Surpass NXT	0 D	Spring	0 D	Spring	Spring	Spring	Spring	4 M
Surveil	9 M	9 M	9 M	9 M	0 D	30 M	30 M	3 M
Synchrony XP	7 M	8 M	9 M	30 M	0 D	30 M	9 M	3 M
Tavium	4 M	0 D ² -42 D ³	6 M	6 M	0 D ⁴ -28 D ⁵	6 M	Spring	4.5 M
Tillam	None	None	None	None	None	None	None	None
TopNotch	0 D	Spring	Spring	Spring	Spring	Spring	Spring	4 M
Treflan	5 M	0 D	5 M	0 D	0 D	0 D	5 M	5 M
Trivence	10 M	18 M	18 M	18 M	0 D	18 M	18 M	4 M
Ultra Blazer	100 D	100 D	100 D	0 D	0 D	100 D	100 D	40 D
Valor SX/Valor EZ								
1.0 oz/A	7-30 D ⁷	7-28 D ⁸	30 D	0 D	0 D	30 D	30 D	30 D
1.5-2.0 oz/A	7-30 D ⁷	7-28 D ⁸	30 D	0 D	0 D	30 D	30 D	30 D
2.1-3.0 oz/A	14-30 D ¹	2 M	30 D	0 D	0 D	2 M	2 M	2 M

¹Cotton may be planted after 12 months where SONIC was applied at rates of 5 oz/A or less and meet the following conditions: medium/fine soils; pH<7.2; and rainfall or irrigation exceed 15 inches after application; ²Dicamba Tolerant Cotton; ³Non-Dicamba Tolerant Cotton; ⁴Dicamba Tolerant Soybean; ⁵Non-Dicamba Tolerant Soybean; ⁶For **corn**: Plant a minimum of 14 days (minimum or strip-till) or 30 days after VALOR SX (conventional tillage system); ⁷For **cotton**: After Valor SX (2.0 oz/A or less) application, conduct strip till operation a minimum of 7 days before planting (regardless of crop residue levels). After conducting strip-till operation, apply Valor SX herbicide a minimum of 28 days before planting (<30% crop residue levels) or 21 days before planting (>30% crop residue levels).

Crop Replant and Rotation Restrictions Guide for Herbicides (cont)

	Corn	Cotton	Grain Sorghum	Peanuts	Soybeans	Sunflower	Tobacco	Wheat
<i>M = months, D = days, Spring = The spring following application, --- = no information on label</i>								
Valor XLT								
Soil pH<7.0	10 M	10 M	10 M	18 M	0 D	10 M	10 M	4 M
Soil pH>7.0	18 M	30 M	18 M	30 M	0 D	30 D	18 M	4 M
Velpar	---	---	---	---	---	---	---	---
Verdict								
10-12 oz/A	0 D	Spring	0 D	Spring	1 M ¹ -2 M ²	Spring	Spring	4 M
13-15 oz/A	0 D	Spring	0 D	Spring	2 M ¹ -3 M ²	Spring	Spring	4 M
Warrant	0 D	0 D	0 D	Spring	0 D	Spring	Spring	4 M
Warrant Ultra	10 M	1 M	18 M	10 M	0 D	18 M	---	4 M
WideMatch	0 D	18 M	12 M	10.5 M	10.5 M	10.5 M	10.5 M	0 D
WideMatch	0 D	18 M	12 M	10.5 M	10.5 M	10.5 M	10.5 M	0 D
Xtendimax								
Up to 33 fl oz/A	15-45 D	0 D ³ /15-45 D ⁴	15-30 D	120 D	0 D ³ /15-45 D ⁴	120 D	120 D	15-45 D
34-88 fl oz/A	120 D	0 D ³ /120 D ⁴	120 D	120 D	0 D ³ /120 D ⁴	120 D	120 D	120 D
Zidua								
1.0 oz/A	0 D	1 M	6 M	4 M	0 D	4 M	18 M	1 M
2.0 oz/A	0 D	2 M	6 M	4 M	0 D	4 M	18 M	1 M
3.0 oz/A	0 D	4 M	10 M	4 M	0 D	4 M	18 M	4 M
4.0 oz/A	0 D	4 M	12 M	4 M	4 M	4 M	18 M	6 M
Zidua SC								
1.75 fl oz/A	0 D	1 M	6 M	1 M	0 D	1 M	9 M	1 M
3.25 fl oz/A	0 D	2 M	6 M	2 M	0 D	2 M	9 M	1 M
5.00 fl oz/A	0 D	4 M	10 M	4 M	0 D	3 M	12 M	4 M
6.50 fl oz/A	0 D	4 M	12 M	4 M	4 M	3 M	12 M	6 M
Zidua PRO	8.5 M	18 M	18 M	4 M	30 D	18 M	18 M	4 M
2,4-D	Only replant in the same growing season with crops registered for 2,4-D use							
2,4-DB	Only replant in the same growing season with crops registered for 2,4-DB use							

¹For coarse textured soils with less than 2% organic matter; ²All other soil types; ³Dicamba Tolerant cotton or soybean varieties only; ⁴Non-Dicamba Tolerant soybean and cotton varieties.

WEED CONTROL IN FIELD CORN

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i>		1.09-2.33 lb	15	60 days	12 hours
+		+			
<i>atrazine</i>		0.88-1.88 lb	5		
Keystone NXT 5.6SC	1.4-3.0 qt				

Comments: KEYSTONE NXT is a RESTRICTED USE PESTICIDE. Apply KEYSTONE NXT up to 45 days prior to planting field corn; However, planting should be done as close as possible to the time of application of KEYSTONE NXT to provide effective weed control during critical early season corn development. For control of emerged weeds at the time of application, tank mix KEYSTONE NXT with GLYPHOSATE, LIBERTY, BANVEL, CLARITY, 2,4-D, or GRAMOXONE. Do not apply KEYSTONE NXT (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3.8 qt per of KEYSTONE NXT per season.

<i>acetochlor</i>		0.703-1.406 lb	15	85 days	12 hours
+		+			
<i>flumetsulam</i>		0.023-0.046 lb	2		
+		+			
<i>clopyralid</i>		0.071-0.142 lb	4		
SureStart II 4.25	1.5-3.0 pt				

Comments: Apply SURESTART II up to 14 days before planting corn. For enhanced control of emerged weeds at the time of burndown application, SURESTART II may be tank mixed with GLYPHOSATE, 2,4-D, LIBERTY, or GRAMOXONE. Do not apply SURESTART II (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 pt/A of SURESTART II in a single application.

<i>acetochlor</i>		1.58-1.75 lb	15	---	12 hours
+		+			
<i>mesotrione</i>		0.17-0.19 lb	27		
+		+			
<i>clopyralid</i>		0.11-0.12 lb	4		
Resicore 3.29SC	2.25-2.5 qt				

Comments: Apply RESICORE up to 28 days before planting corn. RESICORE should be tank mixed with GLYPHOSATE, PARAQUAT, GLUFOSINATE, and/or 2,4-D for control of existing emerged weeds at the time of application. Do not apply more than 3.25 qt of RESICORE per acre per year. Do not make more than two applications of RESICORE per year. Do not apply RESICORE (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

Preplant/Burndown Herbicides for Weed Management in Field Corn (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>dicamba</i>		0.25-0.5 lb	4	---	24 hours
Clarity/Banvel 4 S	8.0-16 oz				

Comments: Apply any time prior to planting corn. Use 16 oz/A rate on medium to fine texture soils with >2.5% organic matter. Use 8 oz/A rate on coarse textured soils with less than 2.5% organic matter.

<i>diuron (various)</i>		0.5-0.8 lb	7	---	12 hours
4 SC	0.5-0.8 qt				

Comments: Apply any time from fall through spring prior to planting corn. Heavy textured soils will require higher application rate. DIURON 4L may be tank mixed with other burndown herbicides, consult tank mix partner label for more details. Plant corn at least 1.5" deep and make sure seed slot is closed. *Do not apply more than 1.6 qt/A of DIURON 4L per year.*

<i>flumetsulam</i>		0.046-0.057 lb	2	85 days	48 hours
+		+			
<i>clopyralid</i>		0.125-0.156 lb	4		
Hornet 68.5 WDG	4.0-5.0 oz				
Stanza 68.5 WDG					

Comments: Apply HORNET up to 30 days before planting corn. If weeds are present at time of application, tank mix HORNET with PARAQUAT, GLYPHOSATE, or 2,4-D. Add COC or NIS at 1.0-2.0 qt per 100 gal of spray solution. **Rainfast interval = 2 hours.**

<i>flumioxazin</i>		0.064-0.096 lb	14	---	12 hours
Valor SX 51 WDG	2.0-3.0 oz				
Valor EZ SC					

Comments: Apply 14 to 30 days prior to planting field corn. Do not apply more than 3 oz/A of VALOR SX during a single growing season. Do not irrigate when corn is emerging to the 2-leaf stage. Do not use on popcorn, sweet corn, or corn grown for seed. Can be tank-mixed with other burndown herbicides (see label).

<i>flumioxazin</i>		0.063-0.094 lb	14	60 days	12 hours
+		+			
<i>pyroxasulfone</i>		0.080-0.120 lb	15		
Fierce 76WDG	3.0-4.5 oz				
Fierce EZ 2.04SC	6.0 fl oz				

Comments: Apply FIERCE/EZ 7 to 30 days prior to planting field corn. Do not apply more than 4.5 oz/A of FIERCE (6.0 fl oz/A of FIERCE EZ) during a single growing season. Add a COC or methylated seed oil at 1 to 2 pt/A or non-ionic surfactant at 0.25% v/v. Use only on no-till or minimum tillage fields where last year's crop residue has not been incorporated into the soil. Do not use on popcorn, sweet corn, or corn grown for seed. Tank mix partners include GLYPHOSATE, 2,4-D LVE, ATRAZINE, BASIS, EXPRESS, HORNET, PYTHON, RESOLVE, SIMAZINE, DICAMBA, PARAQUAT, or WEEDMASTER. Spray equipment, including mixing vessels and nurse tanks, must be cleaned each day following a FIERCE application.

<i>glufosinate</i>		0.53-0.66 lb	10	70 days	12 hours
Liberty 280 2.34SL	29-36 oz				
Interline 2.34SL					

Comments: Thorough spray coverage is essential for optimum performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 gallons or more per acre. See label for further application instructions and tank-mix partners.

Preplant/Burndown Herbicides for Weed Management in Field Corn (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>glyphosate (various)</i>	22-32 oz	0.75-1.13 lb ae	9	---	4 hours
Comments: Apply in 10-20 gal of water 2 to 4 weeks prior to your anticipated planting date to control existing groundcover. Tank mix with 2,4-D amine for enhanced control of cutleaf evening primrose. Consult product label to determine if a surfactant is needed.					
<i>isoxaflutole</i> Balance Flexx 2 SC	3.0-6.0 fl oz	0.047-0.094 lb	27	45 days	12 hours
Comments: BALANCE FLEXX is a RESTRICTED USE PESTICIDE. Apply BALANCE FLEXX up to 30 days before planting corn. Add MSO at 0.5 gal per 100 gal or COC at 1.0 gal per 100 gal of spray solution for weeds 3 inches or less in height. BALANCE FLEXX may be tank mixed with PARAQUAT, GLYPHOSATE, or 2,4-D if weeds are greater than 3 inches in height. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use BALANCE FLEXX on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil). Do not apply more than 6.0 fl oz BALANCE FLEX per 365 day period. Rainfast interval = N/A (suggest 1 hour).					
<i>paraquat (various)</i> 2S 3S	2.0-4.0 pt 1.3-2.7 pt	0.5-1.0 lb	22	---	12 hours
Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Provides better control of chickweed, henbit, purple deadnettle, and cutleaf eveningprimrose than GLYPHOSATE alone. Add NIS at 1 qt per 100 gal of spray solution. Rainfast interval = 30 minutes.					
<i>pyraflufen ethyl</i> ET 0.208 EC ET X 0.338 EC	0.5-2.0 fl oz 0.3-0.6 fl oz	0.0008-0.003 lb	14	---	12 hours
Comments: Field corn may be planted any time after ET application. For best result, apply ET to broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter. Ground application requires minimum of 10 gallons/A.					
<i>pyroxasulfone</i> Zidua 0.85WG	1.5-3.0 oz	0.080-0.16 lb	15	--	12 hours
Comments: Apply ZIDUA 15 to 45 days before planting corn. ZIDUA tank mix partners include ATRAZINE, GLYPHOSATE, LIGHTNING, OUTLOOK, PROWL H2O, SHARPEN, and STATUS. On coarse textured soils, do not apply more than 2.75 oz/A of ZIDUA (0.142 lb ai/A of pyroxasulfone) per cropping season. On all other soil types, do not apply more than 5.0 oz/A of ZIDUA (0.266 lb ai/A of pyroxasulfone) per cropping season.					
<i>rimsulfuron</i> +		0.0157-0.0282 lb	2	---	4 hours
<i>thifensulfuron</i> Leadoff 33.4 DF	1.5-2.7 oz	0.0157-0.0282 lb	2		
Comments: Apply LEADOFF any time after harvest until right before planting corn. LEADOFF tank mix partners may include GLYPHOSATE, PARAQUAT, 2,4-D LVE, DICAMBA, or GLUFOSINATE. No additional surfactant is needed if tank mixed with GLYPHOSATE or LIBERTY with a built-in adjuvant system. Otherwise, add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal or MSO at 0.5 gal per 100 gal of spray solution plus an ammonium nitrogen fertilizer (AMS at 2 lb/A or UAN at 2 qt/A). Do not apply postemergence to corn.					

Preplant/Burndown Herbicides for Weed Management in Field Corn (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>saflufenacil</i>		0.045-0.067 lb	14	80 days	12 hours
Sharpen 2.85SC	2.0-3.0 fl oz				

Comments: Apply SHARPEN 14 to 30 days before planting corn. For optimum SHARPEN burndown activity, add MSO at 1 gal per 100 gal of spray solution plus ammonium nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). SHARPEN may be tank mixed with GLYPHOSATE, CLARITY, ATRAZINE, STATUS, HARNESS, HARNESS XTRA, VERDICT, PROWL H2O, OUTLOOK, GUARDSMAN MAX, and GUARDSMAN MAX LITE. Do not apply SHARPEN after corn emergence or severe crop injury will occur. Do not apply more than 6.0 fl oz (0.134 lb ai/A) of SHARPEN per cropping season. Do not apply SHARPEN where an at-planting application of an organophosphate or carbamate insecticide is planned or has occurred, or severe crop injury may occur. However, SHARPEN may be applied when AZTEC or FORTRESS insecticides if applied at planting as a BAND, T-BAND, or IN-FURROW. SHARPEN may be applied with all other classes of at-planting insecticides including pyrethroids, neonictinoids, and fipronil. **Rainfast interval = 1 hour.**

<i>saflufenacil</i>		0.045-0.067 lb	14	80 days	12 hours
+		+			
<i>dimethenamid-p</i>		0.391-0.586 lb	15		
Verdict 5.57EC	10-15 fl oz				

Comments: Apply VERDICT 14 to 30 days before planting corn. For optimum VERDICT burndown activity, add MSO at 1 gal per 100 gal of spray solution plus ammonium nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). VERDICT may be tank mixed with GLYPHOSATE, CLARITY, ATRAZINE, STATUS, and SHARPEN. Do not apply VERDICT after corn emergence or severe crop injury will occur. Do not apply more than 0.134 lb ai/A saflufenacil from all product sources per cropping season. Do not apply more than 25 fl oz of VERDICT per cropping season. Do not apply VERDICT where an at-planting application of an organophosphate or carbamate insecticide is planned or has occurred, or severe crop injury may occur. However, VERDICT may be applied when AZTEC 2.1% granular, AZTEC 4.67 G granular, or FORTRESS 5G granular insecticides is applied at planting as a BAND, T-BAND, or IN-FURROW. VERDICT may be applied with all other classes of at-planting insecticides including pyrethroids, neonictinoids, and fipronil.

<i>thiencarbazone</i>		0.012 lb	2	45 days	12 hours
+		+			
<i>isoxaflutole</i>		0.031 lb	27		
Corvus 2.63 SC	3.33 fl oz				

Comments: CORVUS is a RESTRICTED USE PESTICIDE. Apply CORVUS up to 30 days before planting corn. Add MSO at 0.5 gal per 100 gal or COC at 1.0 gal per 100 gal of spray solution for weeds 6 inches or less in height. CORVUS may be tank mixed with PARAQUAT, GLYPHOSATE, or 2,4-D if weeds are greater than 6 inches in height. Do not use seed or soil-applied TERBUFOS, PHORATE, FONOPHOS, and other organophosphate or carbamate insecticides in the same season as CORVUS. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use CORVUS on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil). Do not apply more than 5.6 fl oz/A of CORVUS per 365 day period. **Rainfast interval = N/A (suggest 1 hour).**

<i>2,4-D amine</i>		0.5-1.0 lb		---	48 hours
(various)	1.0-2.0 pt		4		
3.8S					

Comments: Apply 7 to 14 days prior to planting field corn. Do not use on a light, sandy soil, or where soil moisture is limiting weed growth. Very effective for cutleaf evening primrose control. Can be tank-mixed with other burndown herbicides (see label).

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Field Corn¹

	ET ²	Glufosinate ²	Glyphosate ²	Glyphosate + 2,4-D ²	Glyphosate + Atrazine ²	Glyphosate + Dicamba ²	Glyphosate + Diuron ²	Glyphosate + Leadoff ²	Glyphosate + Sharpen ²	Glyphosate + Valor SX ²	Paraquat ²	Paraquat + 2,4-D ²	Paraquat + Dicamba ²	Paraquat + Valor SX ²	Paraquat + Diuron ²
barley, little	F	G	E	E	E	E	E	E	E	E	G	G	G	G	G
bluegrass, annual	G	P	F	F	E	F	E	E	E	E	G	G	G	G	G
buttercups	G	E	E	E	E	E	E	E	E	E	E	E	E	E	E
chickweed, common	G	E	F	G	E	GE	GE	E	E	E	E	E	GE	E	E
clovers	P	F	PF	F	F	FG	F	G	E	F	G	G	GE	GE	GE
cudweed	G	G	E	E	E	E	E	E	E	E	FG	FG	FG	FG	FG
dandelion	P	FG	P	E	GE	E	GE	E	G	G	N	E	GE	P	GE
dock, curly	P	G	PF	G	G	GE	F	F	F	G	F	FG	GE	P	F
eveningprimrose, cutleaf	GE	G	PF	E	E	GE	GE	E	E	FG	F	E	GE	E	GE
geranium, Carolina	GE	GE	FG	E	E	E	GE	E	E	E	GE	E	GE	E	E
henbit/deadnettle	G	G	F	G	E	GE	E	E	E	E	G	GE	E	E	GE
horseweed (marestail)	G	GE	E	GE	E	E	E	GE	E	GE	F	GE	E	GE	GE
mustard, wild	G	GE	FG	E	GE	G	GE	G	E	GE	FG	E	G	GE	G
pansy, field	G	G	F	F	GE	F	G	---	E	F	G	G	G	G	GE
peanut, volunteer	F	GE	F	F	F	G	F	P	GE	FG	P	F	GE	F	F
pepperweed, Virginia	G	G	G	E	GE	GE	GE	E	E	G	G	GE	G	G	GE
radish, wild	G	GE	FG	GE	GE	GE	GE	G	E	GE	G	GE	GE	GE	GE
ryegrass, Italian	F	P	G	F	GE	F	FG	E	E	G	FG	FG	FG	FG	G
sorrel, red	F	PF	E	E	E	E	E	G	G	E	E	E	E	E	E
spurry, corn	G	---	GE	GE	GE	GE	GE	E	E	G	FG	G	G	G	G
swinecress	G	GE	FG	G	G	G	G	E	E	FG	PF	FG	FG	PF	FG
vetch	GE	GE	F	E	E	E	G	E	E	FG	G	GE	GE	GE	G
wheat/rye cover crop	P	F	E	E	E	E	G	E	E	E	FG	F	F	G	G

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Herbicide rates for burndown are Atrazine at 1.0 lb/A; ET at 1.0 oz/A; Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ai/gal); 2,4-D at 1-2 pt/A; Clarity at 8 oz/A; Diuron at 1.6 pt/A; Leadoff at 1.5 oz/A; Sharpen at 1.0 oz/A; Paraquat 2S at 3.0 pt/A; Valor SX at 2.0 oz/A; and Glufosinate at 29 oz/A.

Weed Response to Soil Applied Preemergence Herbicides for Corn Weed Management¹

	Acuron	Anthem	Anthem ATZ	Atrazine (ATZ)	Acetochlor	Acetochlor+ATZ	Alachlor	Alachlor+ATZ	Balance Flexx	Corvus	Dimethenamid-p	Hornet
anoda, spurred	G	---	GE	GE	---	GE	---	GE	---	---	---	G
barnyardgrass	FG	E	E	G	E	E	E	E	E	E	E	P
beggarweed, Florida	G	---	E	E	F	P	---	E	---	---	P	FG
bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P
citronmelon	---	---	G	G	P	G	P	G	---	---	P	---
cocklebur, common	G	P	GE	GE	P	GE	P	GE	F	F	P	E
crabgrass	E	E	E	G	E	E	E	E	E	E	E	P
cowpea	E	P	E	E	P	E	P	E	GE	GE	P	G
crotalaria, showy	---	P	GE	GE	P	GE	P	GE	GE	GE	P	G
croton, tropic	E	P	G	G	P	G	P	G	GE	GE	P	P
crowfootgrass	E	GE	GE	G	E	E	E	E	E	E	E	P
dayflower, Benghal	GE	GE	GE	F	GE	GE	---	---	---	---	F	---
eclipta	GE	G	GE	GE	---	GE	---	GE	GE	GE	---	---
goosegrass	E	GE	GE	G	E	E	E	E	E	E	E	P
jimsonweed	E	---	E	E	P	E	P	E	E	E	P	GE
johnsongrass, seedling	E	---	---	P	P	P	P	P	GE	GE	P	P
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P	P	P
lambquarters, common	---	---	E	E	F	E	FG	E	G	G	F	E
morningglory, annual	G	P	G	G	P	G	P	G	F	F	P	FG
nutsedge, purple	P	P	P	P	P	P	P	P	P	P	P	P
nutsedge, yellow	FG	P	P	P	F	FG	F	FG	P	P	FG	P
panicum, fall	E	GE	GE	P	E	E	E	E	GE	GE	E	P
panicum, Texas	F	F	F	P	PF	P	PF	PF	F	F	PF	P
pigweed	E	GE	E	E	G	E	G	E	E	E	G	E
ALS-resistant	E	GE	E	E	G	E	G	E	E	E	G	E
DNA-resistant	E	GE	E	E	G	E	G	E	E	E	G	E
poinsettia, wild	---	---	GE	GE	P	GE	P	GE	G	G	P	G
purslane, common	E	---	E	E	G	E	G	E	G	G	G	---
pusley, Florida	E	G	E	E	GE	E	GE	E	---	---	GE	G
ragweed, common	E	---	E	E	P	E	P	E	GE	GE	P	G
ryegrass, annual	---	GE	GE	---	---	---	---	---	---	---	---	P
sandbur, field	GE	GE	GE	P	FG	FG	FG	FG	F	F	FG	P
senna, coffee	GE	---	FG	FG	P	FG	P	FG	G	G	P	---
sesbania, hemp	GE	---	FG	FG	P	FG	P	FG	G	G	P	---
sicklepod	E	F	G	G	P	G	P	G	GE	GE	P	FG
sida, prickly	E	---	E	E	P	E	P	E	G	G	F	E
signalgrass, broadleaf	GE	FG	FG	P	G	G	FG	FG	G	G	G	P
smartweed, Pennsylvania	GE	P	GE	GE	P	GE	P	GE	GE	GE	P	G
spurge	GE	---	GE	GE	---	GE	---	GE	GE	GE	---	G
starbur, bristly	GE	---	GE	GE	PF	GE	P	GE	G	G	P	G
velvetleaf	E	P	G	G	P	G	P	G	G	G	P	E
vol. peanut	G	P	GE	E	P	GE	P	GE	GE	GE	P	GE

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

Weed Response to Soil Applied Preemergence Herbicides for Corn Weed Management(cont)¹

	Instigate	Lumax/Lexar	S-Metolachlor	S-Metolachlor+ATZ	Princep	Prowl	Python	Resolve	Sharpen	SureStart II	Verdict	Zidua/Zidua SC
anoda, spurred	---	GE	---	GE	G	---	G	---	---	GE	---	---
Barnyardgrass	GE	GE	E	E	G	GE	P	G	P	GE	E	E
beggarweed, Florida	---	E	F	E	G	---	FG	---	---	---	---	P
Bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P
citronmelon	---	---	P	G	F	---	---	---	---	G	---	P
cocklebur, common	G	GE	P	GE	G	P	E	G	G	GE	G	P
crabgrass	GE	GE	E	E	G	GE	P	G	P	GE	E	P
cowpea	---	E	P	E	G	P	G	---	E	E	G	E
crotalaria, showy	---	GE	P	GE	G	---	G	G	G	GE	P	P
croton, tropic	G	G	P	G	G	P	P	---	---	GE	---	---
crowfootgrass	GE	E	E	E	G	E	P	G	P	E	E	E
dayflower, Benghal	---	---	GE	GE	---	---	---	---	---	---	F	GE
eclipta	G	GE	---	GE	GE	G	G	---	GE	GE	GE	---
goosegrass	GE	---	E	E	G	E	P	F	P	E	E	GE
jimsonweed	GE	E	P	E	E	P	GE	G	G	G	G	GE
johnsongrass, seedling	GE	F	F	F	P	E	P	F	P	P	P	GE
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P	P	P
lambquarters, common	G	E	G	E	E	G	E	G	E	E	E	G
morningglory, annual	FG	G	P	G	G	P	FG	F	G	FG	G	P
nutsedge, purple	P	P	P	P	P	P	P	P	P	P	P	P
nutsedge, yellow	P	FG	FG	FG	P	P	P	P	P	P	FG	FG
panicum, fall	GE	GE	E	E	G	FG	P	G	P	E	E	GE
panicum, Texas	GE	PF	PF	P	P	PF	P	F	P	PF	PF	FG
pigweed	G	E	G	E	E	FG	E	FG	E	E	E	GE
ALS-resistant	G	E	G	E	E	FG	P	P	E	E	E	GE
DNA-resistant	G	E	G	E	E	P	E	FG	E	E	E	GE
poinsettia, wild	---	---	P	GE	G	P	G	---	---	GE	---	---
purslane, common	G	G	G	E	---	GE	---	---	---	GE	G	---
pusley, Florida	G	---	GE	E	G	E	G	---	F	GE	F	G
ragweed, common	G	E	PF	E	E	P	G	F	---	G	---	---
ryegrass, annual	GE	---	G	G	E	FG	P	F	P	---	---	G
sandbur, field	GE	FG	FG	FG	G	GE	P	---	---	---	GE	GE
senna, coffee	G	---	P	F	---	P	FG	G	---	FG	---	---
sesbania, hemp	G	---	P	F	---	P	FG	G	---	FG	---	---
sicklepod	GE	G	P	G	G	P	FG	FG	GE	G	GE	F
sida, prickly	---	FG	P	E	E	P	E	F	G	G	F	G
signalgrass, broadleaf	FG	FG	FG	FG	P	GE	P	F	P	FG	FG	G
smartweed, Pennsylvania	G	GE	P	GE	G	P	G	G	G	G	P	P
spurge	G	G	---	GE	G	G	---	---	GE	GE	G	G
starbur, bristly	---	G	P	GE	GE	P	G	---	P	G	P	---
velvetleaf	GE	G	P	G	G	P	E	F	G	E	G	P
vol. peanut	F	G	P	F	F	P	P	P	P	GE	---	P

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

Important Ground and Surface Water Considerations Regarding the Use of Atrazine and Simazine Containing Herbicide Products.

ATRAZINE and SIMAZINE users are strongly encouraged to follow label guidelines, discussed below, to share in the responsibility of preserving the future use of ATRAZINE and SIMAZINE. These restrictions apply to all formulations of ATRAZINE and SIMAZINE, and all pre-mix package products that contain ATRAZINE and SIMAZINE.

Application Rate Restrictions: For soils that are not defined as highly erodible, the maximum use rate for ATRAZINE is 2.0 lb ai (active ingredient) per acre and for SIMAZINE is 2.0 lb ai per acre per season. For soils classified as highly erodible (as defined by NRCS), If conservation tillage is practiced with at least 30 percent crop residue coverage at planting, the maximum use rate is 2.0 lb ai per acre for ATRAZINE and SIMAZINE. If crop residue coverage is less than 30 percent, then the maximum rate for ATRAZINE and SIMAZINE is 1.6 lb ai per acre. If ATRAZINE **was not** applied prior to corn emergence, then the total amount applied should not exceed 2.0 lb ai per acre. If ATRAZINE was applied to a field preemergence, then the total amount of ATRAZINE **should not** exceed 2.5 lb ai per acre per calendar year. The total amount of SIMAZINE **should not** exceed 2.0 lb ai per acre per calendar year.

Setbacks: Operations that involve mixing, loading, rinsing, or washing ATRAZINE or SIMAZINE within 50 feet of wells (including abandoned wells, drainage wells, or sink holes), rivers, intermittent streams, lakes, or reservoirs is prohibited. This restriction does not apply to operations within a properly designed impervious pads and diked mixing/loading areas. ATRAZINE or SIMAZINE must not be applied aerially or by ground equipment within 66 feet of points where field surface water enters perennial or intermittent streams and rivers or within 200 feet around natural or impounded lakes and reservoirs. If ATRAZINE or SIMAZINE is applied to highly erodible land, a 66-foot buffer or setback from runoff entry points must be planted to crop, seeded or grass, or some other cover crop.

If ATRAZINE or SIMAZINE is applied to tile-terraced fields containing standpipes, then users are advised to follow one the following restrictions: 1) do not apply ATRAZINE or SIMAZINE within 66 feet of standpipes; 2) After applying ATRAZINE or SIMAZINE to the entire field, immediately incorporate it to a depth of 2-3 inches; or 3) Apply ATRAZINE or SIMAZINE to the entire field under conservation tillage practices where high crop residue levels are present.

Examples of Herbicide Products that Contain Atrazine or Simazine

Trade Name	Active Ingredient(s)	Trade Name	Active Ingredient(s)
Aatrex	<i>atrazine</i>	Harness Xtra	<i>acetochlor + atrazine</i>
Bicep II Magnum	<i>atrazine + s-metolachlor</i>	Guardsman MAX	<i>dimethenamid-p + atrazine</i>
Bicep Lite II Magnum	<i>atrazine + s-metolachlor</i>	Keystone	<i>acetochlor + atrazine</i>
Bullet	<i>alachlor + atrazine</i>	Lariat	<i>alachlor + atrazine</i>
Cinch ATZ	<i>s-metolachlor + atrazine</i>	Lumax	<i>s-metolachlor + atrazine + mestrione</i>
Degree Xtra	<i>acetochlor + atrazine</i>	Marksman	<i>dicamba + atrazine</i>
Expert	<i>glyphosate + s-metolachlor + atrazine</i>	Princep	<i>simazine</i>
Fultime	<i>acetochlor + atrazine</i>	Steadfast ATZ	<i>nicosulfuron + rimsulfuron + atrazine</i>

Management of Glyphosate-Resistant Palmer Amaranth in Field Corn

Palmer amaranth populations have been documented in South Carolina to be resistant to acetolactate synthase (ALS) inhibiting herbicides (i.e., Accent, Resolve, Steadfast, and Option) and dinitroaniline (yellow) herbicides (i.e., Prowl), and glyphosate (i.e., Roundup, Touchdown). The following table is designed to aid producers in managing herbicide-resistant Palmer amaranth populations in corn.

Seed Program	Herbicide Program		
	PRE ¹	POST ²	POST-DIRECTED ³
<i>Conventional Hybrids</i>			
	atrazine, Harness, Bicep II Magnum, Cinch ATZ, Guardsman, Lexar, Corvus, Verdict, Sharpen, Bullet, Breakree, Balance Flexx, Acuron, Keystone NXT	dicamba, Status, 2,4-D, Impact, Laudis, Callisto, Capreno, atrazine, Armezon, Balance Flexx, Acuron	2,4-D, Evik, Lorox, Status, dicamba
	No PRE applied	dicamba, Laudis, Callisto, Impact Corvus, Capreno, Balance Flexx, Marksman, Buctril + atrazine	
<i>Liberty-Link Hybrids</i>			
	atrazine, Harness, Bicep II Magnum, Cinch ATZ, Guardsman, Lexar, Corvus, Verdict, Sharpen, Bullet, Breakree, Balance Flexx	Liberty + dicamba Liberty + 2,4-D Liberty + Armezon Liberty + Warrant	2,4-D, Evik, Lorox, Status, dicamba
	No PRE applied	Liberty + atrazine + Callisto Liberty + dicamba Liberty + atrazine + Laudis Liberty + atrazine + Impact Liberty + atrazine + Warrant	
<i>Roundup Ready Hybrids</i>			
	atrazine, Harness, Bicep II Magnum, Cinch ATZ, Guardsman, Lexar, Corvus, Verdict, Sharpen, Bullet, Breakree, Balance Flexx	glyphosate + atrazine glyphosate + dicamba glyphosate + 2,4-D glyphosate + Armezon glyphosate + Warrant Halex GT	2,4-D, Evik, Lorox, Status, Clarity
	No PRE applied	glyphosate + s-metolachlor + atrazine glyphosate + atrazine + Laudis glyphosate + s-metolachlor + Callisto glyphosate + atrazine + Impact glyphosate + atrazine + Warrant Halex GT	

¹ PRE = Preemergence. Apply to soil surface after all tillage and planting has occurred.

² POST = Postemergence. Consult individual product labels for corn height restrictions, e.g., atrazine applied POST limited to corn 12 inches tall or less.

³ Consult individual product label regarding specific corn height restrictions.

Preemergence Herbicides for Weed Management in Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>acetochlor</i>			15	120 days	12 hours
Breakfree 6.4 EC	1.5-2.5 pt	1.2-2.0 lb			
Harness 7 E	1.5-3.0 pt	1.3-2.6 lb			
Surpass 6.4 EC	1.5-2.5 pt	1.2-2.0 lb			
Surpass NXT 7EC	1.25-2.25 pt	1.1-2.0 lb			
TopNotch 3.2 ME	2.0-3.0 qt	1.6-2.4 lb			

Comments: HARNESS is a RESTRICTED USE PESTICIDE. Controls most annual grasses (*except Texas panicum*) and small-seeded broadleaf weeds. ACETOCHLOR can be tank-mixed with ATRAZINE for improved broadleaf weed control. Do not apply ACETOCHLOR to the following soils within 150ft (50ft for SURPASS/NXT) of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year.

<i>acetochlor</i>		1.125-2.063 lb	15	---	12 hours
Warrant 3.0 ME	1.5-2.75 qt				

Comments: Apply WARRANT after corn planting but before weeds germinate. Provides residual control of small-seeded broadleaves and grasses. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Labeled tank mix partners include AIM, BALANCE PRO, BALANCE FLEXX, CALLISTO, CLARITY, DISTINCT, GLYPHOSATE, LINEX 4L, LOROX DF, MARKSMAN, PRINCEP, RESOURCE, 2,4-D, ATRAZINE, and PARAQUAT. Do not apply ACETOCHLOR within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Application of WARRANT followed by poor environmental conditions (cool wet soils and/or waterlogged soils) may result in crop response. Do not use WARRANT preplant, at-planting, or preemergence to sweet corn.

<i>acetochlor</i>		1.65-2.1 lb	15	60 days	12 hours
+		+			
<i>atrazine</i>		1.24-1.58 lb	6		
Breakfree ATZ 5.25 SC					

Comments: BREAKFREE ATZ is a RESTRICTED USE PESTICIDE. Application use rate is based on soil texture and organic matter content: Sandy soils = 2.2-2.6 qt/A, medium textured soils = 2.4-2.8 qt/A. Use higher rate for each soil texture if applying in a reduced tillage system. Do not apply BREAKFREE ATZ to the following soils within 150ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year. Do not apply ACETOCHLOR through any irrigation system or using aerial application equipment.

<i>acetochlor</i>		1.35-2.50 lb	15	60 days	12 hours
+					
<i>atrazine</i>		0.67-1.24 lb	5		
FulTime NXT 4.04 SC	2.0-3.7 qt				

Comments: FULTIME NXT is a RESTRICTED USE PESTICIDE. The application rate of FULTIME NXT is based on organic matter content of the soil: For soils with less than 1.5% organic matter, application rate range is 2.0-2.9 qt/A. For soils with 1.5% organic matter or more, the application rate range is 2.3-3.7 qt/A. Use only on sorghum seed treated with a safener. Do not apply FULTIME to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year.

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i>		1.09-2.33 lb	15	60 days	12 hours
+		+			
<i>atrazine</i>		0.88-1.88 lb	5		
Keystone NXT 5.6 SC	1.4-3.0 qt				

Comments: KEYSTONE NXT is a RESTRICTED USE PESTICIDE. Apply KEYSTONE NXT after planting (or after corn emergence up to 11 inches in height). Planting should be done as close as possible to the time of application of KEYSTONE NXT to provide effective weed control during critical early season corn development. Do not apply more than 3.8 qt per of KEYSTONE NXT per season. KEYSTONE NXT may be tank mixed with AIM, ATRAZINE, BALANCE PRO, BALANCE FLEXX, BANVEL, CALLISTO, CALLISTO XTRA, CLARITY, DISTINCT, DURANGO DMA, HORNET WDG, LINEX 4L, LOROX DF, MARKSMAN, PRINCEP, PYTHON WDG, RESOURCE, or 2,4-D.

<i>acetochlor</i>		1.5-2.05 lb	15	60 days	12 hours
+		+			
<i>mesotrione</i>		0.14-0.19 lb	27		
Harness MAX 3.85 SC	55-75 fl oz				

Comments: Apply *acetochlor+mesotrione* after planting (or after corn emergence up to 11 inches in height). If weeds are emerged at the time of application, add either a NIS at 1 qt per 100 gal of spray solution or COC at 1 gal per 100 gal of spray solution for improved weed control. In addition, a nitrogen fertilizer added to the tank mixture may improve weed control (i.e., AMS). Do not apply more than 95 fl oz/A of *acetochlor+mesotrione* per year. *Acetochlor+mesotrione* may be tank mixed with *atrazine*, *glyphosate*, and *glufosinate* for enhanced control of existing weeds.

<i>acetochlor</i>		0.703-1.406 lb	15	85 days	12 hours
+		lb			
<i>flumetsulam</i>		+	2		
+		0.023-0.046 lb	4		
<i>clopyralid</i>		lb			
SureStart II 4.25 SC	1.5-3.0 pt	+			
		0.071-0.142 lb			

Comments: SURESTART II is a RESTRICTED USE PESTICIDE. Apply SURESTART II after planting (or after crop emergence up to 11 inches in height) into a clean seedbed. Plant corn at least 1.5" deep. Use of SURESTART II on soils with less than 1.5% organic matter may result in crop injury. If an ALS herbicide such as CANOPY, CLASSIC, PURSUIT, SCEPTER, or SQUADRON was applied in the previous year, apply SURESTART II to corn only if the rotational restrictions have been met. Extended cold, wet conditions following application of SURESTART II to corn during germination and early crop development may result in crop injury. Injury symptoms including yellowing leaves or stunting are usually temporary and plants recover without affecting yield. Soil applied organophosphate insecticides (except TERBUFOS or PHORATE) must be applied in a T-band or a band and not in-furrow to avoid potential crop injury. Do not use COUNTER (TERBUFOS) or THIMET (PHORATE) insecticides. Other corn soil insecticides from other classes of chemistry may be applied in-furrow, T-banded, or banded. Do not apply SURESTART II (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 pt/A of SURESTART II in a single application. *Do not plant cotton within 18 months of application.*

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>acetochlor</i> + <i>mesotrione</i> + <i>clopyralid</i> Resicore 3.29 SC		1.58-1.75 lb + 0.17-0.19 lb + 0.11-0.12 lb	15 27 4	---	12 hours
	2.25-2.5 qt				

Comments: Apply RESICORE after planting corn into a clean seedbed. RESICORE may be tank mixed with ATRAZINE for enhance residual broadleaf weed activity. Do not apply more than 3.25 qt of RESICORE per acre per year. Do not make more than two applications of RESICORE per year. Do not apply RESICORE (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

<i>atrazine</i> Aatrex 4 SC		1.6-2.0 lb	5	60 days	12 hours
	1.6-2.0 qt				

Comments: ATRAZINE is a RESTRICTED USE PESTICIDE. Use to control mostly broadleaf weeds and a few grasses. Tank mix with *acetochlor*, *s-metolachlor*, *pyroxsulfone* or *dimethenamid-p* for improved grass control.

<i>atrazine</i> + <i>pyroxasulfone</i> + <i>fluthiacet-methyl</i> Anthem ATZ 4.505 SC		0.88-1.25 lb + 0.106-0.152 lb + 0.003-0.004 lb	5 15 14	60 days	12 hours
	1.75-2.5 pt				

Comments: ANTHEM ATZ is a RESTRICTED USE PESTICIDE. Application rate is based on soil texture: coarse textured 1.75-2 pt/A; medium textured 2.0-2.5 pt/A. Provides small-seeded grass and broadleaf weed control. Tank mix with *atrazine*, BALANCE, or HORNET for control of additional weed species.

<i>dimethenamid-p</i> Outlook 6 EC		0.47-0.75 lb	15	40 days	12 hours
	10-16 oz				

Comments: Controls most annual grasses (*except Texas panicum*) and some broadleaf weeds. DIMETHENAMID-P may be tank-mixed with *atrazine* or *simazine*.

<i>flumetsulam</i> Python 80 WDG		0.05 lb	2	85 days	12 hours
	1.0 oz				

Comments: For flood prone areas where ATRAZINE cannot be used or where soybeans may be re-planted. Plant corn at least 1.5" deep. Mix with a preemergence grass herbicide and apply on the surface. Soil applied organophosphate insecticides should be applied in a T-band or a band to avoid potential crop injury. Do not apply PYTHON if COUNTER or THIMET insecticides were applied previously. Other corn insecticides should be applied in a T-band to avoid injury. *Do not plant cotton within 18 months of application.*

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>flumetsulam</i> + <i>clopyralid</i> Hornet 68.5 WDG Stanza 68.5 WDG	4.0-5.0 oz	0.046-0.057 lb + 0.125-0.156 lb	2 4	85 days	48 hours

Comments: Apply HORNET at the time of planting or after planting, but prior to crop or weed emergence. Corn must be planted a minimum of 1.5 inches deep. Application of HORNET WDG or STANZA on soils with less than 1.5% organic matter may result in crop injury. Soil applied organophosphate insecticides should be applied in a T-band or a band to avoid potential crop injury. Do not apply HORNET WDG or STANZA if COUNTER (*terbufos*) or THIMET (*phorate*) insecticides were applied previously. Other corn insecticides should be applied in a T-band to avoid injury. Do not plant cotton within 18 months of application.

<i>isoxaflutole</i> Balance Flexx 2 SC	3.0-6.0 fl oz	0.047-0.094 lb	27	45 days	12 hours
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Comments: BALANCE FLEXX is a RESTRICTED USE PESTICIDE. Apply BALANCE FLEXX during planting (behind the planter after furrow closure) or after planting, but before weeds emerge. Failure to thoroughly close and firm the seed furrow may allow herbicide to directly contact seed which can cause injury. Controls *glyphosate- and ALS-resistant Palmer amaranth*. Add up to 1.5 lb ATRAZINE/A to enhance residual control of weeds. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use BALANCE FLEXX on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil).

<i>pendimethalin</i> Prowl H ₂ O 3.8 CS Prowl 3.3 EC	1.55-3.13 pt 1.8-3.6 pt	0.74-1.49 lb	3	21 days	24 hours
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Comments: Do not apply *pendimethalin* preplant incorporated or serious corn injury may result. Plant corn at least 1.5 in. deep. Corn seed must be completely covered with soil. Apply after planting before emergence of weeds. Use the higher rates on fine-textured soils. In case of stand failure, corn seed should be replanted below the herbicide treated zone. Add ATRAZINE at 1.0 to 2.0 qt/A for control of broadleaf weeds.

<i>pyroxasulfone</i> Zidua 0.85 WDG Zidua SC 4.17 SC	1.5-3.0 oz 2.5-5.0 fl oz	0.080-0.16 lb	15	---	12 hours
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Comments: Apply ZIDUA after planting corn but before crop emergence. Corn seed must be planted at least 1 inch deep. ZIDUA tank mix partners include ATRAZINE, GLYPHOSATE, OUTLOOK, PROWL H₂O, SHARPEN, and STATUS. On coarse textured soils, do not apply more than 2.75 oz/A of ZIDUA or 4.5 fl oz/A of ZIDUA SC per cropping season. On all other soil types, do not apply more than 5.0 oz/A of ZIDUA or 8.25 fl oz/A of ZIDUA SC per cropping season.

<i>pyroxasulfone</i> + <i>fluthiacet-methyl</i> Anthem 2.15 EC	5.0-10.0 fl oz	0.082-0.163 lb + 0.003-0.005 lb	15 14	70 days	12 hours
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Comments: Provides small-seeded grass and broadleaf weed control. Application rate is based on soil texture: coarse textured 5.0-8.0 fl oz/A; medium textured 6.5-10.0 fl oz/A. Tank mix with ATRAZINE, BALANCE, or HORNET for control of additional weed species.

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>rimsulfuron</i>	0.5-2.0 oz			30 days	4 hours
Resolve 25 DF/SG		0.008-0.031 lb	2		

Comments: Controls most annual grasses and broadleaves including broadleaf signalgrass. For control of emerged weeds at the time of application, add NIS at 1 qt/100 gal or COC at 1 gal/100 gal of spray solution plus 2 qt/A of UAN (28-32% N) or 2 lb/A of spray grade AMS.

<i>rimsulfuron</i>		0.034 lb	2	None	12 hours
+		+			
<i>mesotrione</i>		0.34 lb	27		
Instigate 45.8 WDG	6.0 oz				

Comments: Apply INSTIGATE after corn planting but before crop emergence. Seed furrow must be firmly closed so that INSTIGATE spray does not contact the seed. Do not apply more than 0.0625 lb ai of RIMSULFURON (i.e., from LEADOFF, PREQUEL, REALM Q, or STEADFAST Q) during the crop year. Do not apply COUNTER (*terbufos*) within 60 days of a preemergence or preplant application of INSTIGATE. Do not apply INSTIGATE preemergence to coarse-textured soils (sand, loamy sand, or sandy loam) with less than 1% organic matter. INSTIGATE may be tank mixed with ATRAZINE, GLYPHOSATE, DICAMBA, 2,4-D, CINCH, or BREAKFREE.

<i>rimsulfuron</i>		0.0157 lb	2	---	4 hours
+					
<i>thifensulfuron</i>		0.0157 lb	2		
Leadoff 33.4 DF	1.5 oz				

Comments: Apply LEADOFF after corn planting but before crop emergence. LEADOFF tank mix partners may include GLYPHOSATE, PARAQUAT, 2,4-D LVE, DICAMBA, or GLUFOSINATE. No additional surfactant is needed if tank mixed with GLYPHOSATE or LIBERTY with a built-in adjuvant system. Otherwise, add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal or MSO at 0.5 gal per 100 gal of spray solution plus an ammonium nitrogen fertilizer (AMS at 2 lb/A or UAN at 2 qt/A). Do not apply after corn has emerged. Allow at least 3 weeks between LEADOFF preemergence and postemergence applications of rimsulfuron containing herbicides (i.e., REALM Q, STEADFAST Q or RESOLVE Q). Do not apply LEADOFF to corn where THIMET (*phorate*) is planned due to crop injury potential.

<i>s-metolachlor</i>		0.96-1.27 lb	15	30 days	24 hours
Dual Magnum 7.62 EC	1.0-1.33 pt				
Dual II Mag. 7.64 EC					
Cinch 7.64 EC					

Comments: METOLACHLOR and S-METOLACHLOR can be tank mixed with ATRAZINE. Generic formulations of METOLACHLOR are also available. DUAL II and DUAL II MAGNUM contain a safener that helps reduce the possibility of injury from S-METOLACHLOR applications.

<i>s-metolachlor</i>		0.78-1.27 lb	15	60 days	24 hours
+		+			
<i>atrazine</i>		1.0-1.63 lb	5		
Bicep II Magnum 5.5 SC	1.3-2.1 qt				

Comments: BICEP II MAGNUM is a RESTRICTED USE PESTICIDE. *Application use rate is based on soil texture:* Sandy soils = 1.3-1.6 qt/A, Medium textured soils = 1.6-2.1 qt/A. Use higher rate for each soil type if applying in a reduced tillage system. Available as a pre-mix with GLYPHOSATE (EXPERT).

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>s-metolachlor</i>		0.78-0.96 lb	15	60 days	24 hours
+		+			
<i>atrazine</i>		1.0-1.24 lb	5		
Cinch ATZ 5.5 SC	2.6-3.2 pt				

Comments: CINCH ATZ is a RESTRICTED USE PESTICIDE. Application rate is based on soil type: Sandy soils = 2.6 pt/A, medium textured soils = 3.2 pt/A. Use higher rate for each soil type if applying in a reduced tillage system.

<i>s-metolachlor</i>		1.68 lb	15	60 days	24 hours
+		+			
<i>mesotrione</i>		0.17 lb	27		
+		+			
<i>atrazine</i>		0.63 lb	5		
Lumax 3.95 SC	2.5 qt				

Comments: LUMAX is a RESTRICTED USE PESTICIDE. Apply LUMAX after planting (or after corn emergence up to 12 inches in height). Do not apply more than 3.0 qt per acre of LUMAX per season. LUMAX may be tank mixed with ATRAZINE, PRINCEP, GRAMOXONE, GLYPHOSATE, LIBERTY, and WARRIOR. Tank mixes with 2,4-D are allowed but should be done with extreme care, check compatability before mixing into a load. 2,4-D batches vary greatly and should be tested for compatability each time a water or carrier source, water or carrier temperature, product source, or tank mixture recipe is changed.

<i>s-metolachlor</i>		1.31 lb	15	60 days	24 hours
+		+			
<i>mesotrione</i>		0.17 lb	27		
+		+			
<i>atrazine</i>		1.31 lb	5		
Lexar EZ 3.7 SC	3.0 qt				

Comments: LEXAR is a RESTRICTED USE PESTICIDE. Apply LEXAR after planting (or after corn emergence up to 12 inches in height). Do not apply more than 3.5 qt per acre of LEXAR per season. LEXAR may be tank mixed with 2,4-D, ATRAZINE, PRINCEP, PARAQUAT, GLYPHOSATE, LIBERTY, and WARRIOR. Conduct a tank mix compatability test each time 2,4-D is added to the tank mixture with LEXAR. Temporary corn injury may occur if LEXAR is applied to emerged corn that has received an at-plant application of an organophosphate insecticide (except COUNTER). Do not make a postemergence application of LEXAR to emerged corn with any organophosphate or carbamate insecticide, or severe crop injury may occur. Do not apply a solo HPPD inhibitor postemergence (i.e., CALLISTO, IMPACT, or LAUDIS) to ground that has been treated with LEXAR in the same season.

<i>s-metolachlor</i>		1.34 lb	15	60 days	24 hours
+		+			
<i>atrazine</i>		0.625 lb	5		
+		+			
<i>mesotrione</i>		0.15 lb	27		
+		+			
<i>bicyclopyrone</i>		0.038 lb	27		
Acuron 3.44 SC	2.5 qt				

Comments: ACURON is a RESTRICTED USE PESTICIDE. Provides good to excellent control of most grass and broadleaf weeds. Tank mix partners include ATRAZINE, PRINCEP, GLYPHOSATE, and WARRIOR.

Preemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>saflufenacil</i>		0.045-0.067 lb	14	80 days	12 hours
Sharpen 2.85SC	2.0-3.0 fl oz				

Comments: Apply SHARPEN after planting but before crop emergence. For control of weeds that are emerged at time of planting, add MSO at 1 gal per 100 gal of spray solution plus ammonium nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). SHARPEN may be tank mixed with GLYPHOSATE, CLARITY, ATRAZINE, STATUS, HARNESS, HARNESS XTRA, VERDICT, PROWL H2O, OUTLOOK, GUARDSMAN MAX, and GUARDSMAN MAX LITE. Do not apply SHARPEN after corn emergence or severe crop injury will occur. Do not apply more than 6.0 fl oz (0.134 lb ai/A of saflufenacil) of SHARPEN per cropping season. Do not apply SHARPEN where an at-planting application of an organophosphate or carbamate insecticide is planned or has occurred, or severe crop injury may occur. However, SHARPEN may be applied when AZTEC or FORTRESS insecticides if applied at planting as a BAND, T-BAND, or IN-FURROW. SHARPEN may be applied with all other classes of at-planting insecticides including pyrethroids, neonicotinoids, and fipronil.

<i>saflufencil</i>		0.045-0.067 lb	14	80 days	12 hours
+		+			
<i>dimethenamid-p</i>		0.391-0.586 lb	15		
Verdict 5.57EC	10-15 fl oz				

Comments: Apply VERDICT after corn planting but before crop emergence. If weeds are present at planting, add MSO at 1 gal per 100 gal of spray solution plus ammonium nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). VERDICT may be tank mixed with GLYPHOSATE, CLARITY, ATRAZINE, STATUS, and SHARPEN. Do not apply VERDICT after corn emergence or severe crop injury will occur. Do not apply more than 0.134 lb ai/A saflufenacil from all product sources per cropping season. Do not apply more than 25 fl oz of VERDICT per cropping season. Do not apply VERDICT where an at-planting application of an organophosphate or carbamate insecticide is planned or has occurred, or severe crop injury may occur. However, VERDICT may be applied when AZTEC 2.1% granular, AZTEC 4.67 G granular, or FORTRESS 5G granular insecticides are applied at planting as a BAND, T-BAND, or IN-FURROW placement. VERDICT may be applied with all other classes of at-planting insecticides including pyrethroids, neonicotinoids, and fipronil.

<i>thiencarbazone</i>		0.012 lb	2	45 days	12 hours
+		+			
<i>isoxaflutole</i>		0.049 lb	27		
Corvus 2.63 SC	3.33 fl oz				

Comments: CORVUS is a RESTRICTED USE PESTICIDE. Apply CORVUS during planting (behind the planter after the press wheel) or after planting, but before weeds emerge. Failure to thoroughly close and firm the seed furrow row may allow herbicide to directly contact seed which can cause injury. Controls *glyphosate- and ALS-resistant Palmer amaranth*, sicklepod, and prickly sida. Add 1.0 lb ATRAZINE/A to enhance residual control of weeds. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use CORVUS on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil).

<i>2,4-D amine (various)</i>		0.5-1.0 lb	4	---	48 hours
3.8EC	1.0-2.0 pt				

Comments: Apply after planting field corn, but before crop emergence to control existing broadleaf weed seedlings. Do not use on a light, sandy soil, or where soil moisture is limiting weed growth. Very effective for cutleaf evening primrose control. Can be tank-mixed with other preemergence herbicides (see label).

Weed Response to Postemergence Herbicides for Field Corn Weed Management¹

	POSTEMERGENCE																			
	Acuron	Accent/NIC-IT	Aim	Atrazine (ATZ)	Balance Flexx	Basagran	Beacon	Buctril	Cadet	Callisto	Capreno	Corvus	Dicamba	Expert ²	Glyphosate ²	Halex GT ²	Impact/Armezon	Keystone/Fultime ⁴	Laudis	Liberty ³
anoda, spurred	G	FG	P	E	---	P	F	---	---	G	---	---	GE	E	GE	GE	---	E	---	G
barnyardgrass	FG	GE	P	GE	GE	G	P	P	G	G	GE	E	P	E	E	E	GE	GE	GE	G
beggarweed, Florida	G	G	F	G	GE	P	GE	G	G	G	GE	GE	G	E	E	E	G	G	GE	GE
bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P	P	F	F	F	P	P	P	P
citronmelon	---	---	FG	E	GE	P	---	G	FG	G	GE	GE	E	E	E	E	---	E	---	E
cocklebur, common	G	F	G	E	G	E	GE	E	G	E	E	G	E	E	E	E	E	E	E	E
cowpea	GE	---	FG	G	GE	P	---	FG	FG	GE	GE	GE	E	G	G	GE	GE	G	GE	G
crabgrass	E	GE	P	G	G	P	P	P	P	P	GE	G	P	E	E	E	P	G	P	G
crotalaria, showy	---	---	F	GE	GE	P	---	G	G	---	GE	GE	G	G	E	E	GE	GE	GE	G
croton, tropic	E	---	G	G	G	GE	---	FG	G	P	G	G	GE	G	G	G	---	G	---	G
crowfootgrass	E	E	P	G	GE	P	P	P	P	P	---	---	P	E	E	E	P	G	P	G
dayflower, Bengal	F	---	GE	P	---	FG	---	---	---	---	---	---	P	---	F	F	---	---	---	PF
eclipta	GE	---	FG	GE	GE	FG	---	G	FG	G	GE	GE	G	E	E	E	GE	---	GE	G
goosegrass	E	E	P	G	GE	P	P	P	P	P	E	G	P	E	E	E	P	G	P	G
jimsonweed	E	FG	G	E	E	E	E	E	G	E	E	E	E	E	GE	GE	GE	E	GE	G
johnsongrass, seedling	E	E	P	F	G	P	E	P	P	P	E	G	P	E	E	E	P	F	P	GE
johnsongrass, rhizome	P	GE	P	P	P	P	G	P	P	P	P	P	P	E	E	E	P	P	P	F
lambsquarters, common	GE	P	GE	E	GE	FG	PF	G	G	E	GE	GE	E	E	E	E	GE	E	GE	E
morningglory, annual	G	F	E	G	G	P	PF	G	G	GE	GE	G	E	FG	FG	GE	GE	G	GE	E
nutsedge, purple	P	P	P	P	F	P	P	P	P	F	F	F	P	G	G	G	P	P	P	P
nutsedge, yellow	FG	P	P	PF	F	G	PF	P	P	F	F	F	P	FG	FG	FG	P	PF	P	P
panicum, fall	E	G	P	G	G	P	G	P	P	P	E	G	P	E	E	E	P	G	P	G
panicum, Texas	F	GE	P	F	FG	P	PF	P	P	P	GE	F	P	E	E	E	P	F	P	F
pigweed	E	GE	G	E	E	P	GE	G	G	E	GE	E	GE	E	E	E	GE	GE	GE	FG
glyphosate-resistant	E	GE	G	E	E	P	GE	G	G	E	GE	E	GE	G	P	E	GE	GE	GE	FG
ALS-resistant	E	P	G	E	E	P	P	G	G	E	GE	E	GE	E	E	E	GE	GE	GE	FG
poinsettia, wild	---	---	---	---	---	---	---	---	---	---	---	---	G	GE	GE	GE	---	---	---	---
purslane, common	E	---	G	E	---	P	---	---	---	---	---	---	E	G	G	G	---	---	---	G
pusley, Florida	E	P	FG	G	---	P	GE	E	---	---	GE	---	G	P	P	P	---	G	---	FG
ragweed, common	E	P	F	GE	---	G	---	G	---	F	E	---	E	E	GE	GE	F	GE	GE	E
ryegrass, annual	P	GE	P	FG	GE	P	FG	F	F	P	GE	GE	P	E	E	E	---	---	F	FG
sandbur, field	GE	E	P	F	G	P	PF	P	P	P	E	F	P	GE	GE	GE	P	F	P	G
senna, coffee	GE	FG	P	FG	---	P	FG	F	---	F	---	---	E	GE	GE	GE	---	FG	---	G
sesbania, hemp	GE	PF	F	FG	GE	P	P	G	G	P	---	---	E	F	F	F	G	---	G	GE
sicklepod	E	PF	P	P	GE	P	GE	P	G	P	GE	GE	E	E	E	E	GE	G	P	E
sida, prickly	E	P	F	GE	G	G	G	F	G	P	G	G	G	E	G	G	---	GE	E	GE
signalgrass, broadleaf	GE	GE	P	F	P	P	P	P	P	P	GE	---	P	GE	GE	GE	P	F	P	G
smartweed, Pennsylvania	GE	G	G	G	---	E	G	GE	---	G	GE	---	E	G	G	G	GE	G	GE	E
spurge	GE	---	FG	GE	GE	F	G	GE	G	G	GE	GE	G	E	E	E	GE	FG	G	G
starbur, bristly	GE	---	P	E	---	E	---	F	---	E	---	---	E	E	GE	E	---	E	---	G
velvetleaf	E	F	E	G	E	GE	PF	G	F	GE	E	E	FG	G	G	GE	GE	G	GE	GE
vol. peanut	FG	G	P	G	GE	P	F	P	P	P	GE	GE	G	G	G	G	GE	G	GE	E
vol. RR soybean	GE	G	P	E	E	P	P	F	P	G	GE	E	E	E	P	G	GE	E	GE	G

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Use only on glyphosate-tolerant (Roundup Ready, Roundup Ready 2, Agrisure GT) corn hybrids.

³Use only on Liberty Link corn hybrids.

⁴For control of listed weeds, these herbicides must be applied prior to weed emergence or tank mixed with a foliar active herbicide.

Weed Response to Postemergence Herbicides for Field Corn Weed Mgmt (cont)¹

	POSTEMERGENCE														POSTEMERGENCE-DIRECTED						
	Marksman	Option	Prowl ⁴	Pursuit ²	Realm Q	Resolve	Resolve Q	Revulin Q	Sandea	Sequence ³	Status	Steadfast/Q	Steadfast ATZ	Stinger	Warrant ⁴	2,4-D	Aim	Evik	Linuron	Paraquat	2,4-D
anoda, spurred	GE	---	P	---	---	---	G	P	GE	GE	FG	E	P	---	G	P	G	E	---	GE	G
barnyardgrass	P	G	GE	P	GE	G	GE	G	P	E	P	E	E	P	GE	P	G	E	---	GE	P
beggarweed, Florida	FG	P	---	P	---	---	---	G	P	E	GE	---	---	GE	---	P	---	E	E	E	P
bermudagrass	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P	P
citronmelon	G	P	---	PF	---	---	---	GE	PF	E	E	---	G	FG	---	E	G	G	E	F	E
cocklebur, common	E	G	P	E	---	P	PF	E	G	E	E	FG	E	GE	P	E	G	F	E	G	E
cowpea	E	P	---	P	---	---	---	GE	---	E	E	---	G	GE	P	E	---	G	G	G	E
crabgrass, large	P	FG	GE	F	G	F	F	GE	P	E	P	PF	FG	P	GE	P	P	E	G	G	P
crotalaria, showy	---	P	---	P	---	---	---	---	P	E	GE	---	---	GE	---	G	G	E	E	G	G
croton, tropic	GE	P	P	PF	---	---	---	---	---	GE	GE	---	GE	G	---	G	---	G	G	G	G
crowfootgrass	P	F	GE	F	F	PF	PF	GE	P	E	P	E	GE	P	G	P	P	E	E	G	P
dayflower, Bengal	---	P	---	FG	---	---	---	---	P	F	---	---	---	---	---	GE	---	GE	F	GE	GE
eclipta	G	---	G	GE	GE	G	G	G	P	E	GE	---	---	---	G	G	FG	G	G	FG	G
goosegrass	P	F	GE	F	F	PF	PF	GE	P	E	P	P	GE	P	GE	P	P	E	E	G	P
jimsonweed	E	G	P	PF	G	P	P	GE	---	GE	E	G	E	G	G	E	GE	E	E	G	E
johnsongrass seedling	P	E	G	PF	F	PF	PF	GE	P	E	F	E	E	P	G	P	P	E	E	G	P
johnsongrass rhizome	P	G	P	P	P	P	P	G	P	E	P	G	GE	P	P	P	P	P	P	P	P
lambsquarters, common	E	G	P	P	G	PF	PF	GE	PF	GE	E	F	E	P	G	E	G	E	E	FG	E
morningglory spp.	E	F	P	FG	F	P	P	G	PF	G	E	G	G	P	FG	GE	G	G	G	G	GE
nutsedge, purple	F	P	P	G	PF	P	P	P	G	FG	P	P	P	P	P	P	P	G	F	F	P
nutsedge, yellow	F	P	P	F	F	P	P	F	GE	FG	P	P	PF	P	P	PF	P	G	F	F	PF
panicum, fall	P	G	GE	F	G	F	F	FG	P	E	F	G	G	P	GE	P	P	E	E	G	P
panicum, Texas	P	F	F	PF	G	F	F	F	P	E	P	G	E	P	G	P	P	GE	GE	E	P
pigweed	E	G	F	G	GE	PF	PF	GE	FG	E	E	G	E	G	G	GE	G	E	G	G	GE
glyphosate-resistant	E	G	F	G	GE	PF	PF	GE	FG	P	E	G	E	G	G	GE	G	E	G	G	GE
ALS-resistant	E	P	F	P	GE	P	P	GE	P	E	E	P	E	G	G	GE	G	E	G	G	GE
poinsettia, wild	---	P	---	E	---	---	---	---	---	E	GE	---	E	---	---	---	FG	---	---	FG	---
purslane, common	---	P	---	P	---	---	---	---	---	E	E	---	E	---	---	G	G	E	G	G	G
pusley, Florida	GE	P	GE	PF	---	---	---	FG	---	FG	G	FG	GE	FG	FG	G	FG	E	G	FG	G
ragweed, common	E	G	P	P	G	P	P	FG	GE	GE	E	FG	E	G	F	E	P	E	E	G	E
ryegrass, annual	---	G	GE	P	F	G	G	G	P	E	P	F	F	P	GE	P	P	E	E	G	P
sandbur, annual	P	F	G	P	F	F	PF	G	P	E	P	PF	PF	P	GE	P	P	E	E	G	P
senna, coffee	GE	P	P	FG	---	---	---	G	---	GE	GE	FG	FG	G	---	G	P	E	G	G	G
sesbania, hemp	GE	P	P	P	G	P	P	G	FG	GE	E	---	E	---	---	G	P	PF	G	PF	G
sicklepod	GE	F	P	P	F	---	---	FG	P	GE	GE	PF	E	FG	P	E	P	E	E	G	E
sida, prickly	E	---	P	GE	F	P	P	FG	F	GE	GE	P	GE	---	F	G	G	E	G	FG	G
signalgrass, broadleaf	P	F	GE	P	F	PF	PF	F	P	E	P	GE	GE	P	GE	P	P	GE	G	G	P
smartweed, Pennsylvania	E	PF	P	G	G	P	P	G	FG	GE	E	FG	GE	F	P	PF	G	G	G	FG	PF
spurge	G	---	G	G	---	---	---	---	---	E	GE	---	GE	G	---	G	F	G	G	FG	G
starbur, bristly	GE	P	P	F	---	---	---	---	G	GE	GE	---	E	FG	---	GE	---	E	G	G	GE
velvetleaf	E	G	P	G	G	PF	PF	G	E	G	GE	F	G	---	G	G	E	G	G	GE	G
vol. peanut	E	P	P	P	---	---	---	---	P	G	GE	G	G	FG	P	P	P	GE	G	P	P
vol. RR soybean	E	P	P	P	---	---	---	---	---	P	GE	G	E	E	P	FG	P	E	P	G	GE

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Use only on Clearfield corn hybrids.

³Use only on glyphosate-tolerant (Roundup Ready, Roundup Ready 2, Agrisure GT) corn hybrids.

⁴For control of listed weeds, these herbicides must be applied prior to weed emergence or tank mixed with a foliar active herbicide.

Postemergence Herbicides for Weed Management in Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i>		1.13-2.25 lb	15	40 days	12 hours
Warrant 3.0ME	1.5-3.0 qt				

Comments: Apply WARRANT over-the-top to corn from seedling emergence until corn reaches 30 inches in height. Drop nozzles are recommended for optimum spray coverage and weed control when corn height is 24 to 30 inches. Weeds emerged at time of application will not be controlled by WARRANT. If weeds are emerged at time of application, tank mix a labeled postemergence corn herbicide with WARRANT. Do not make a postemergence surface application using a sprayable fluid fertilizer as the carrier because severe crop injury may occur. Do not exceed 4 qt per acre per season when making a second application of WARRANT. Do not use WARRANT on sweet corn. Tank mix partners include 2,4-D, ATRAZINE, AIM, AXIOM, BALANCE, DICAMBA, DISTINCT, PYTHON, RESOURCE, GLYPHOSATE, LOROX, CALLISTO, MARKSMAN, PROWL, and RESOLVE.

<i>acetochlor</i>		1.35-2.50 lb	15	60 days	12 hours
+					
<i>atrazine</i>		0.67-1.24 lb	5		
FulTime NXT 4.04 SC	2.0-3.7 qt				

Comments: FULTIME NXT is a RESTRICTED USE PESTICIDE. Apply FULTIME NXT before corn exceeds 11 inches in height. Application rate is based on organic matter content of the soil: For soils with less than 1.5% organic matter, application rate range is 2.0-2.9 qt/A. For soils with 1.5% organic matter or more, the application rate range is 2.3-3.7 qt/A. FULTIME NXT may be applied before, with, or following postemergence herbicides in corn: AIM, ATRAZINE, BALANCE FLEX BANVEL, CALLISTO, CAPRENO, CLARITY, DISTINCT, DURANGO DMA, HORNET WDG, IMPACT, LAUDIS, LIBERTY, LINEX 4L, LOROX DF, MARKSMAN, RESOURCE, STATUS, or 2,4-D. Do not apply FULTIME NXT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai per acre per year.

<i>acetochlor</i>		1.09-2.33 lb	15	60 days	12 hours
+		+			
<i>atrazine</i>		0.88-1.88 lb	5		
Keystone NXT 5.6 SC	1.4-3.0 qt				

Comments: KEYSTONE NXT is a RESTRICTED USE PESTICIDE. Apply KEYSTONE NXT after emergence up to 11 inches in height. Do not apply more than 3.8 qt per per of KEYSTONE NXT per season. Postemergence KEYSTONE NXT tank mix partners may include ACCENT, AIM, ATRAZINE, BALANCE FLEXX, BANVEL, BASIS, BASIS GOLD, BEACON, BUCTRIL, CALLISTO, CALLISTO XTRA, CAPRENO, CLARITY, DISTINCT, HORNET WDG, IMPACT, LAUDIS, LIBERTY, LIGHTNING, LINEX 4L, LOROX DF, MARKSMAN, PEAK, PERMIT, PROWL, PENDIMAX, PURSUIT, RESOURCE, SHOTGUN, SPIRIT, STATUS, STEADFAST, or 2,4-D.

<i>acetochlor</i>		1.10-1.51 lb	15	60 days	12 hours
+		+			
<i>mesotrione</i>		0.10-0.14 lb	27		
Harness MAX	40-55 fl oz				

Comments: Apply HARNESS MAX after corn emergence up to 11 inches in height. If weeds are emerged at the time of application, add either a NIS at 1 qt per 100 gal of spray solution or COC at 1 gal per 100 gal of spray solution for improved weed control. In addition, a nitrogen fertilizer added to the tank mixture may improve weed control (i.e., AMS). Do not apply more than 95 fl oz/A of HARNESS MAX per year. HARNESS MAX may be tank mixed with *atrazine*, *glyphosate*, and *glufosinate* for enhanced control of existing weeds. Do not make more than 2 applications of HARNESS MAX per year. Do apply a CARBAMATE or ORGANOPHOSPHATE insecticide postemergence to corn within 7 days before or after a HARNESS MAX application as severe corn injury may occur (challenging environmental conditions may also increase the risk of injury).

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>acetochlor</i>		0.703-1.406 lb	15	85 days	12 hours
+		+			
<i>flumetsulam</i>		0.023-0.046 lb	2		
+		+			
<i>clopyralid</i>		0.071-0.142 lb	4		
SureStart II 4.25	1.5-3.0 pt				

Comments: Apply SURESTART II from planting until corn reaches 11 inches in height. Do not apply SURESTART II postemergence if corn was previously treated with COUNTER (TERBUFOS) or THIMET (PHORATE) as severe crop injury may result. Postemergence applications to corn previously treated with T-band, band, or in-furrow applications of other organophosphate insecticides, such as LORSBAN, AZTEC, or FORTRESS insecticide may cause temporary crop injury. Do not tank mix SURESTART II with foliar postemergence organophosphate insecticides as severe crop may result. To avoid crop injury, apply the foliar organophosphate insecticide at least 10 days before or 10 days after the application of SURESTART II. Do not apply SURESTART II to sweet corn or popcorn. *Do not plant cotton within 18 months of application.* Do not apply SURESTART II to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 pt/A of SURESTART II in a single application.

<i>acetochlor</i>		1.58-1.75 lb	15	45 days	12 hours
+		+			
<i>mesotrione</i>		0.17-0.19 lb	27		
+		+			
<i>clopyralid</i>		0.11-0.12 lb	4		
Resicore 3.29SC	2.25-2.5 qt				

Comments: Apply RESICORE after corn emergence up to 11 inches in height. RESICORE may be tank mixed with ATRAZINE for enhanced broadleaf and grass weed control. For control of emerged grasses, tank mix RESICORE with ACCENT Q or STEADFAST Q in conventional corn. RESICORE may be tank mixed with GLYPHOSATE for glyphosate-tolerant corn or LIBERTY for glufosinate-tolerant corn. Apply RESICORE when weeds are small (1-2 inches in height). Do not apply RESICORE to emerged corn that has received an at-plant application of PHORATE or TERBUFOS insecticide or severe crop injury may occur. Postemergence applications of any organophosphate or carbamate insecticide within 7 days before or 7 days after a RESICORE application may result in severe corn injury. Do not apply more than 3.25 qt of RESICORE per acre per year. Do not make more than two applications of RESICORE per year. Do not apply RESICORE (acetochlor) to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

<i>atrazine</i>		1.0-2.0 lb	5	None	12 hours
Aatrex 4 SC	1.0-2.0 qt				

Comments: Apply ATRAZINE to corn from emergence up to 12 inches in height. Add COC at 1 gal per 100 gal of spray mix. If ATRAZINE was not applied prior to corn emergence, up to 2 lbs ai/A may be applied. If an earlier ATRAZINE application was made, the total ATRAZINE applied may not exceed 2.5 lbs ai/acre per calendar year. **Rainfast interval not indicated on label (suggest 1 hour minimum).**

<i>bentazon</i>		0.75-1.0 lb	6	12 days	48 hours
Basagran 4 S	1.5-2.0 pt				
Basagran 5 L	0.8-1.6 pt				

Comments: Treat when broadleaf weeds are small and actively growing. Do not apply to weeds that are under stress such as moisture or herbicide injury, as unsatisfactory control may result. Adjust rate according to weed size as indicated on the product label. Add COC to the spray tank at rate of 1 qt/A. Do not apply more than 2 lb *bentazon* per acre of per season. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>bromoxynil</i>		0.25-0.38 lb	6	45 days	24 hours
Maestro 2EC	1.0-2.0 pt				
Maestro 4EC	0.5-1.0 pt				
+	+	+			
<i>atrazine</i> 4 SC	1.0-2.0 qt	1.0-2.0 lb	5		
Comments: Apply BUCTRIL otop corn from 4 leaf growth stage (V4) up to before tassel emergence to control <i>glyphosate- and ALS-resistant and Palmer amaranth (less than 2 inches in height)</i> . Apply when weeds are in the 2- to 4-leaf stage or less than 6 inches tall. Less danger of volatility drift than 2,4-D or BANVEL. Tank mixtures with BANVEL, 2,4-D, or CLARITY may cause stalk brittleness. Tank mixes with liquid fertilizers may cause excessive leaf burn. Rainfast interval not indicated on label (suggest 1 hour minimum).					
<i>carfentrazone</i>		0.008-0.016 lb	14	3 days	12 hours
Aim 2 EC	0.5-1.0 fl oz				
Comments: Apply AIM broadcast to corn from emergence until 8 leaf collar growth stage (V8). Excellent control of small sicklepod, <i>glyphosate-resistant Palmer amaranth</i> , and morningglory. Add a COC (1-2 gal/100 gals), NIS (1 qt/100 gals), or MSO (1-2 gal/100 gals). May be tank mixed with GLYPHOSATE for broader spectrum weed control in Roundup Ready corn. **Consult AIM product label regarding specific recommendations for preharvest intervals. Rainfast interval = 6 hours					
<i>clopyralid</i>		0.124-0.25 lb	4	---	12 hours
Stinger 3.0SL	0.33-0.67 pt				
Comments: Apply STINGER over-the-top corn from emergence up to 24 inches tall to control small broadleaf weed species. Use higher rate for larger weeds. Apply with ground equipment as a broadcast spray in 10 gallons of water or more to ensure uniform and through spray coverage of the weed foliage. STINGER may be tank mixed with HORNET WDG. See label for additional information. Corn inbred lines or breeding stock may be injured by STINGER. Do not apply more than 0.67 pt STINGER per acre per year. Do not allow livestock to graze treated areas or harvest treated corn silage as feed within 40 days after last treatment. Rainfast interval = 6 hours.					
<i>dicamba</i>		0.25-0.5 lb	4	**	24 hours
Banvel/Clarity 4 S	0.5-1.0 pt				
Comments: Apply BANVEL or CLARITY at the 1.0 pt rate otop corn from the spike stage up to 8-inch tall corn or 5 leaf collar stage (V5) to provide early control of vines and broadleaf weeds. Apply the 0.5 pt/A rate from the 8-inch tall up to 36-inch tall corn or 15 days before tassel emergence, whichever comes first. For best performance, apply when weeds are less than 3 inches tall. Use directed applications when corn leaves prevent proper spray coverage, sensitive crops are growing nearby, or tank mixing with 2,4-D. Do not apply BANVEL or CLARITY under conditions which favor drift onto nearby crops. **Corn treated with BANVEL or CLARITY may be harvested or used for feed once the crop has reached the milk stage of development. Rainfast interval not indicated on label (suggest 1 hour minimum).					
<i>dicamba</i>		0.28-0.48 lb	4	60 days	24 hours
+		+			
<i>atrazine</i>		0.53-0.92 lb	5		
Marksman 3.2 S	2.0-3.5 pt				
Comments: MARKSMAN is a RESTRICTED USE PESTICIDE. Apply MARKSMAN otop corn from emergence through the 5-leaf growth stage (V5) or 8 inches tall. Controls <i>glyphosate- and ALS-resistant Palmer amaranth</i> . Reduce MARKSMAN rate to 2.0 pt/A on coarse textured soils (sand, loamy sand, and sandy loam). Do not use COC after corn emergence as crop injury may result. A maximum of 5.25 pt/A per season is allowed. A NIS may be added to the spray tank. Rainfast interval = 4 hours.					

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>dicamba</i> +		0.223-0.446 lb	4	**	24 hours
<i>diflufenzopyr</i> +		0.089-0.178 lb	19		
<i>isoxadifen</i> Status 56WDG	5-10 oz	safener			
Comments: Apply STATUS over-the-top on corn from V2 (4 inches tall) to V10 (36 inches tall) growth stages. Controls <i>glyphosate-</i> and <i>ALS-resistant Palmer amaranth</i> . Add NIS at 1 qt or COC at 1.0-2.0 pt/A or MSO at 1.0-2.0 pt/A per 100 gal plus nitrogen fertilizer at 5.0 qt per 100 gal or AMS at 8.5 lb/A. Do not apply under weather conditions that favor drift onto nearby, sensitive crops. Do not apply more than 12.5 oz/A of STATUS per season. Do not apply STATUS using a nitrogen fertilizer solution as a carrier. Do not apply if corn is more than 36 inches tall (V10 stage) or 15 days before tassel emergence, whichever comes first. **Do not harvest for corn grain and stover within 72 days of STATUS application or do not harvest corn for fodder within 32 days of STATUS application. Rainfast interval = 4 hours.					
<i>flumetsulam</i> +		0.023-0.057 lb	2	85 days	48 hours
<i>clopyralid</i> Hornet 68.5 WDG Stanza 68.5 WDF	2.0-5.0 oz	0.063-0.156 lb	4		
Comments: Apply HORNET or STANZA from emergence (spike stage) until corn reaches 20 inches in height (or the V6 growth stage). Include a NIS at 1 qt/100 gal or COC/MSO at 1 gal/100 gal of spray volume. Postemergence applications of HORNET or STANZA to corn previously treated with T-band, band, or in-furrow applications of other organophosphate insecticides, such as LORSBAN, AZTEC, FORTRESS, or DYFONATE, may cause temporary crop injury. Do not tank mix HORNET or STANZA with foliar postemergence organophosphate insecticides as severe crop injury may result. Foliar organophosphate insecticide should be applied as least 10 days before or after the application of HORNET or STANZA. Do not apply HORNET or STANZA if COUNTER (terbufos) or THIMET (phorate) insecticides were applied at planting. HORNET or STANZA may be tank mixed with other foliar non-organophosphate insecticides. <i>Do not plant cotton within 18 months of application.</i> Rainfast interval = 2 hours.					
<i>fluthiacet methyl</i> Cadet 0.91EC	0.9 oz	0.006 lb	14	60 days	12 hours
Comments: Apply CADET broadcast to corn from 2 leaf growth stage (V2) up to 48 inches in height, but before tasseling. Excellent control of small sicklepod, <i>glyphosate-resistant Palmer amaranth</i> , and morningglory. Add either a COC (1-2 pt/A) or NIS (1 qt/100 gals) plus UAN at 1-2 qt/A or spray grade AMS at 8.5 lb/100 gals. May be tank mixed with glyphosate for broader spectrum weed control in Roundup Ready corn. Do not apply more than 1.25 oz/A CADET per season. Rainfast interval = 4 hours.					
<i>foramsulfuron</i> Option 35 DF	1.5-1.75 oz	0.003-0.038 lb	2	**	12 hours
Comments: Apply OPTION to corn from the V1 to the V6 growth stage. Use directed or drop nozzles for applications at the V7-V8 growth stage. Add methylated or ethylated seed oil at 1.5 pt/A in combination with a nitrogen fertilizer (1.5-2 qt/A of UAN or 1.5-3 lb/A of AMS). Do not use OPTION in the same season as COUNTER 15G (all uses), COUNTER 20CR (in-furrow), DYFONATE (all uses) and THIMET (all uses). Foliar applications of an OP insecticide should not occur within 7 days of an OPTION application. In fields heavily infested with johnsongrass, apply only to virus tolerant hybrids. **Do not apply OPTION within 70 days of harvesting grain or 45 days of harvesting corn forage. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. Rainfast interval = 2 hours.					

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>glufosinate</i>		0.53-0.59 lb	10	**	12 hours
Liberty 280 2.34 SL	29-32 fl oz				
Interline 2.34SL					

Comments: USE ONLY ON LIBERTY-LINK CORN HYBRIDS! Apply LIBERTY overtop on corn from emergence up to the 24-inch-tall corn (V7). For corn 24 to 36 inches tall, use drop nozzles. Avoid spraying into the whorl or leaf axils of the corn stalks. *Controls glyphosate- and ALS-resistant Palmer amaranth (less than 4")*. Use the 32 oz/A rate of LIBERTY when targeting Palmer amaranth. Always add AMS at 3 lb/A when applying LIBERTY. Do not add NIS or COC as it may increase crop response. Do not exceed 44 oz LIBERTY per acre per season. Do not use nitrogen solutions as spray carriers. **Do apply LIBERTY within 60 days of harvesting corn forage and within 70 days of harvesting corn grain and corn fodder. **Rainfast interval = 4 hours.**

Resistance Management: Tank mix GLUFOSINATE with a residual herbicide(s) at each application. Soil residual herbicides at burndown and at planting will help ensure optimum weed management particularly if environmental conditions delay timely sprayer operations. Overlapping residual herbicides are an effective strategy to reduce weed resistance development.

<i>glyphosate (various)</i>	22-32 oz	0.75-1.12 lb ae	9	50 days	4 hours
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Comments: USE ONLY ON GLYPHOSATE-TOLERANT CORN HYBRIDS! Apply GLYPHOSATE broadcast in corn up to the V8 growth stage (about 30" tall) before weeds exceed 4 inches in height. Use drop nozzles for 30-48" tall corn to avoid spraying in to the whirls of the plants. Allow a minimum of 10 days between applications. May be tank mixed with ATRAZINE (*application restricted to 12" tall corn*) for residual control. A single in-crop application must not exceed 1.12 lb ae/A. A sequential application must not exceed 1.12 lb ae/A (2.24 lb ae/A total for in-crop applications through 48 inch corn). **Rainfast interval = heavy rainfall soon after application may wash product from the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Resistance Management: *Glyphosate-and ALS-resistant Palmer amaranth biotypes are common in South Carolina. Apply multiple herbicide modes-of-action at each application (foliar plus residual herbicides) to prevent selection of new resistant biotypes of Palmer amaranth. Overlapping residual herbicides are an effective strategy to reduce weed resistance development.*

<i>glyphosate</i>		0.56-0.71 lb ae	9	50 days	24 hours
+		+			
<i>s-metolachlor</i>		0.56-0.70 lb	15		
Sequence 5.25	2.0-2.5 pt				

Comments: USE ONLY ON GLYPHOSATE-TOLERANT CORN HYBRIDS! Apply SEQUENCE from emergence up till corn plants reach 30 inches tall. Applications from 30 to 48 inches require drop nozzles to ensure SEQUENCE does not contact the whorl of the plant. Do not exceed 3.5 pt/A in a single application or 5.0 pt/A total per year. Can be tank mixed with ATRAZINE for improved residual broadleaf weed control (consult label for additional tank mix choices). **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>glyphosate</i> +		0.47-0.71 lb ae	9	60 days	24 hours
<i>s-metolachlor</i> +		1.09-1.63 lb	15		
<i>atrazine</i> Expert 4.88 L	2.5-3.75 qt	1.33-2.0 lb	5		

Comments: USE ONLY ON GLYPHOSATE-TOLERANT CORN HYBRIDS! EXPERT is a RESTRICTED USE PESTICIDE. Apply EXPERT from emergence up till 12 inches tall corn. EXPERT provides excellent control of several broadleaf and grass weeds while providing residual control of weeds that have not emerged. **Rainfast interval = 2 hours.**

<i>halosulfuron</i> Sanda 75WDG	0.67-1.33 oz	0.031-0.062 lb	2	30 days	12 hours
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Comments: Apply SANDEA over-the-top to corn from emergence through the layby stage. Use drop nozzles after canopy prevents adequate coverage of weeds. Controls yellow and purple nutsedge. Add NIS at 1 qt per 100 gals spray solution. Tank mix partners include BANVEL, 2,4-D, BUCTRIL, and ATRAZINE. Please observe and follow the more restrictive application timings on the tank mix partner labels. Do not exceed 2.67 oz per acre per season. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

<i>isoxaflutole</i> Balance Flexx 2 SC	3.0-5.0 fl oz	0.047-0.078 lb	27	45 days	12 hours
+	+	+			
<i>atrazine</i> 4 SC	1.0 pt	0.5 lb	5		

Comments: BALANCE FLEXX is a RESTRICTED USE PESTICIDE. Apply BALANCE FLEXX overtop on corn from spiking through the 2-leaf collar stage (V2). Controls *glyphosate- and ALS-resistant Palmer amaranth*, sicklepod, and prickly sida. Add 0.5 lb/A ATRAZINE to enhance control of weeds larger than 6 inches (*restricts broadcast application to corn 12 inches tall or less*). Do not use COC or MSO with BALANCE FLEXX applied to emerged corn. Do not apply tank-mixes of BALANCE FLEXX with organophosphate or carbamate insecticides to emerged corn. Foliar applications of organophosphate or carbamate insecticides should not be made within 7 days of an application of BALANCE FLEXX. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use BALANCE FLEXX on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil). **Rainfast interval = N/A (suggest 1 hour).**

<i>mesotrione</i> Callisto 4 SC	3.0 fl oz	0.094 lb	27	45 days	12 hours
+	+	+			
<i>atrazine</i> 4 SC	1.0 qt	1.0 lb	5		

Comments: Apply CALLISTO + ATRAZINE overtop corn up to 12 inches tall. [Note: without ATRAZINE, CALLISTO may be applied to corn up to 30 inches tall or 8 leaf growth stage (V8)]. Provides good control of *glyphosate- and ALS-resistant and Palmer amaranth*. Apply before Palmer amaranth reaches 5 inches. Always add COC at 1 gal/100 gal of spray mix and UAN at a rate of 2.5% v/v or AMS at a rate of 8.5 lbs/100 gal. Do not use MSO adjuvants with CALLISTO as severe crop injury may occur. Do not apply more than 7.7 fl oz/A of CALLISTO per season. Do not make more than 2 applications of CALLISTO per season. Delay second application until 14 days after the first. **Rainfast interval = 12 hours.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>nicosulfuron</i>		0.031 lb	2	30 days	4 hours
Accent 75 DF	0.67 oz				
Accent Q 54.5 WDG	0.9 oz				
NIC-IT 2 EC	2.0 oz				

Comments: Apply ACCENT, ACCENT Q, or NIC-IT overtop or with drop nozzles to control rhizome johnsongrass 8 to 18" tall. ACCENT, ACCENT Q, and NIC-IT may be applied overtop corn up to 20 inches tall. For corn from 20 to 36 inches tall, use drop nozzles to avoid spraying in to the whorl of the plant. Add NIS at 1 qt/100 gal or COC at 1 gal/100 gal of spray mix plus 2 qt/A of UAN or 2 lb/A of AMS. Do not apply ACCENT, ACCENT Q, or NIC-IT to corn previously treated with COUNTER 15G, or COUNTER 20CR (in-furrow) unless hybrid is IR (imidazolinone resistant). Injury may occur when ACCENT, ACCENT Q, or NIC-IT is applied to corn previously treated with soil-applied THIMET, LORSBAN or COUNTER 20CR T-banded. In fields heavily infested with johnsongrass, apply only to virus tolerant hybrids. Do not use on sweet corn. Do not tank mix ACCENT, ACCENT Q, or NIC-IT with foliar-applied organophosphate insecticides as severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

<i>nicosulfuron</i>		0.031-0.036 lb	2	70 days	12 hours
+					
<i>mesotrione</i>		0.078-0.092 lb	27		
Revulin Q 51.2DF	3.4-4.0 oz				

Apply REVULIN Q over-the-top to corn from emergence up to 20-inch corn or 6 collars visible, whichever is more restrictive. For applications to corn from 20 to 30 inches tall, use drop nozzles only and avoid spraying into the whorl of the plant. Do not apply to corn after height exceeds 30 inches. Optimum application timing is when corn is 12 inches or less and weeds are small and actively growing. Add COC at 1 gal per 100 gal plus nitrogen fertilizer solution at 2 qt/A or ammonium sulfate at 2 lb/A. Do not use methylated seed oil adjuvants or blends with REVULIN Q. If activating rainfall is not received within 7 days of application, a follow-up with cultivation or a sequential application of ACCENT Q or GLYPHOSATE may be needed. Do not apply more than 4.0 oz/A of REVULIN Q in a growing season. Do not tank mix REVULIN Q with BASAGRAN or severe crop injury may occur. Do not apply REVULIN Q within 45 days of crop emergence where COUNTER was applied. Do not tank mix REVULIN Q with a foliar organophosphate insecticides, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. To avoid crop injury, apply these products as least 7 days before or 3 days after application of REVULIN Q. Do not apply REVULIN Q aerially or apply through any type of irrigation system. **Rainfast interval = 4 hours.**

<i>nicosulfuron</i>		0.023 lb	2	30 days	4 hours
+		+			
<i> rimsulfuron</i>		0.012 lb	2		
Steadfast 75DF	0.75 oz				
Steadfast Q 37.7 WDG	1.5 oz				

Comments: Apply STEADFAST over-the-top corn up to 20" tall or 6 collars (V6), whichever is more restrictive. Add COC at 1 gal per 100 gallons or NIS at 1 qt per 100 gallons. Add nitrogen fertilizer solution at 2 qt/A or AMS at 4 lb/A. Do not apply to corn previously treated with COUNTER 15G, or COUNTER 20CR (in-furrow). Injury may occur when STEADFAST is applied to corn previously treated with soil applied LORSBAN, THIMET, or COUNTER 20CR T-banded. Do not tank mix STEADFAST or with BASAGRAN or LADDOCK or severe crop injury may occur. Do not tank mix STEADFAST with a foliar applied organophosphate insecticide, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>nicosulfuron</i> +		0.024 lb +	2	60 days	12 hours
<i>rimsulfuron</i> +		0.011 lb +	2		
<i>atrazine</i> Steadfast ATZ 89.3 WDG	14 oz	0.75 lb	5		

Comments: Apply STEADFAST ATZ over-the-top corn from emergence up to 12 inches tall or up and exhibiting 6 collars (V6). Add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal of spray mix plus 2 qt/A of UAN or 2 lb/A of AMS. Do not apply STEADFAST ATZ to corn previously treated with a soil insecticide such as COUNTER 15G, COUNTER 20CR (in-furrow), THIMET, LORSBAN, or COUNTER 20CR (T-banded). Do not tank mix STEADFAST ATZ with any 2,4-D containing products as severe grass control antagonism may occur. Do not tank mix STEADFAST ATZ with BASAGRAN or LADDOCK or severe crop injury may occur. Do not tank mix STEADFAST ATZ with a foliar applied organophosphate insecticide, such as LORSBAN, MALATHION, PARATHION, etc., or severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

<i>pendimethalin</i> Prowl H ₂ O 3.8 CS Prowl 3.3 EC +	2.0-3.0 pt 1.8-2.4 pt +	0.95-1.43 lb 0.75-1.0 lb +	3	21 days	24 hours
<i>atrazine</i> 4 SC	1.5-2.0 qt	1.5-2.0 lb	5		

Comments: Apply PROWL over-the-top after corn emergence up to 12-inch-tall (V4) corn but when seedling grasses are less than 1 inch tall. If ATRAZINE is not used, PROWL can be applied up to 30-inch-tall corn. Use the higher rates on fine-textured soils. In case of stand failure, corn seed should be replanted below the herbicide treated zone. **Rainfast interval not indicated on label (suggest 1 hour).**

<i>primisulfuron</i> Beacon 75 DF	0.76 oz	0.036 lb	2	60 days	12 hours
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Comments: Apply BEACON overtop, directed or semi-directed to control rhizome johnsongrass 8 to 16 inches tall. BEACON may be applied broadcast overtop corn up to 20 inches tall. Directed or semi-directed applications may improve weed coverage and minimize crop injury. Add NIS at 1.0 qt/100 gal of spray mix, or COC at 1.0 to 4.0 pt/A. Do not apply BEACON to corn previously treated with COUNTER 15G, or COUNTER 20 CR (in-furrow) unless hybrid is IR (imidazolinone resistant). Injury may occur where BEACON is applied to corn previously treated with soil-applied LORSBAN or COUNTER 20CR T-banded. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 4 hours.**

<i>rimsulfuron</i> Resolve 25 DF	1.0 oz	0.016 lb	2	30 days	4 hours
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Comments: Apply RESOLVE 25DF overtop to corn from emergence up to 12-inch corn or 6 leaf collars visible, whichever is more restrictive. Provides suppression of Palmer amaranth. Add NIS at 1.0 qt per 100 gal plus nitrogen fertilizer at 2.0 qt/A or AMS at 2 lb/A. If rainfall is not received within 7 days of application, a follow-up cultivation or a sequential application of ACCENT may be needed. Do not apply more than 2.0 oz/A of RESOLVE 25 DF in a growing season. Do not tank mix RESOLVE 25 DF with BASAGRAN or severe crop injury may occur. Do not tank mix RESOLVE 25 DF with a foliar applied organophosphate insecticide, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval not indicated on label (suggest 1 hour).**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>rimsulfuron</i> +		0.019 lb	2	70 days	12 hours
<i>mesotrione</i> Realm Q 38.75DF	4.0 oz	0.078 lb	27		

Comments: Apply REALM Q over-the-top to corn from emergence up to 20 inches (or 7 or more collars visible), whichever is more restrictive. Add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal plus nitrogen fertilizer solution at 2 qt/A or ammonium sulfate at 2 lb/A. Do not apply more than 4.0 oz/A of REALM Q per growing season. If activating rainfall is not received within 7 days of application, a follow-up with cultivation or a sequential application of ACCENT Q or GLYPHOSATE may be needed. Do not tank mix REALM Q with BASAGRAN or severe crop injury may occur. Do not apply REALM Q within 45 days of crop emergence where COUNTER was applied since crop injury may occur. Do not tank mix RESOLVE Q with a foliar applied organophosphate insecticide, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. To avoid crop injury, apply these products as least 7 days before or 3 days after application of REALM Q. Do not apply REALM Q aerially or apply through any type of irrigation system. Do not apply to field corn grown for seed. **Rainfast interval = 4 hours.**

<i>rimsulfuron</i> +		0.003 lb	2	30 days	4 hours
<i>thifensulfuron</i> Resolve Q Resolve Q (mp) 22.4 DF	1.25 oz	0.014 lb	2		

Comments: Apply RESOLVE Q over-the-top to corn from emergence up to 20-inch corn or 5 collars visible, whichever is more restrictive. Provides suppression of Palmer amaranth. Add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal or MSO at 0.5 gal per 100 gal plus nitrogen fertilizer solution at 2 qt/A or ammonium sulfate at 2 lb/A. If rainfall is not received within 7 days of application, a follow-up with cultivation or a sequential application of ACCENT may be needed. Do not apply more than 2.5 oz/A of RESOLVE Q in a growing season. Do not apply RESOLVE Q within 45 days of crop emergence where COUNTER was applied since crop injury may occur. Do not tank mix RESOLVE Q with BASAGRAN or severe crop injury may occur. Do not tank mix RESOLVE Q with foliar applied OP insecticides, such as LORSBAN, MALATHION, PARATHION, etc., as severe crop injury may occur. Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval not indicated on label (suggest 1 hour).**

<i>s-metolachlor</i> +		0.67-1.34 lb	15	60 days	24 hours
<i>atrazine</i> +		0.313-0.625 lb	5		
<i>mesotrione</i> +		0.075-0.15 lb	27		
<i>bicyclopyrone</i> Acuron 3.44 SC	1.25-2.5 qt	0.019-0.038 lb	27		

Comments: ACURON is a RESTRICTED USE PESTICIDE. Apply ACURON from emergence up to 12 inches in height before broadleaf weeds are greater than 3 inches in height. Do not apply ACURON in liquid fertilizer or severe crop injury may occur. ACURON applied alone will not provide consistent postemergence control of emerged grass weeds. Do not apply more than 2.5 qt/A of ACURON per growing season. Tank mix partners include ATRAZINE, ACCENT Q, STEADFAST Q, GLYPHOSATE, and WARRIOR. **Rainfast interval not indicated on label (suggest 1 hour minimum).**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>s-metolachlor</i>		0.94-1.05 lb	15	45 days	24 hours
+		+			
<i>glyphosate</i>		0.94-1.05 lb	9		
+		+			
<i>mesotrione</i>		0.094-0.105 lb	27		
Halex GT 4.39 SC	3.6-4.0 pt				

Comments: USE ONLY ON GLYPHOSATE-TOLERANT CORN HYBRIDS! Apply HALEX GT overtop corn from emergence up to 30 inches in height or the 8-leaf stage of corn growth. HALEX GT must be applied with a NIS at 1-2 qt/100 gal of spray mix. Use the higher rate of NIS when weeds are growing under stress conditions. In addition to NIS, add spray grade AMS at 8.5-17 lb/100 gal of spray mix. The use of UAN instead of AMS is not recommended due to risk of crop injury. If tank mixing HALEX GT with atrazine, do not apply when corn exceed 12 inches in height. Temporary crops response (transient bleaching) may occur under extreme weather conditions or when the crop is suffering from stress. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

<i>tembotrione</i>		0.082 lb	27	45 days	12 hours
Laudis 3.5 SC	3.0 fl oz	+			
+	+	0.5 lb	5		
<i>atrazine</i> 4 SC	1.0 pt				

Comments: Apply LAUDIS overtop on corn from emergence up to the 8-leaf collar stage (V8). Controls glyphosate- and ALS-resistant Palmer amaranth. Add 0.5 lb/A ATRAZINE to enhance control of weeds larger than 6 inches (restricts application to corn 12" tall or less). Add MSO at 1 gal per 100 gal of spray mix plus 1.5 qt/A of UAN or 1.5 lb/A of spray grade AMS. Do not use nitrogen fertilizer solution as the primary carrier for applying LAUDIS. Do not use NIS as weed control performance will be erratic. A second sequential 3 fl oz/A application can be made (wait a minimum of 7 days). Do not exceed 6 oz/A per growing season. **Rainfast interval = 1 hour.**

<i>thiencarbazone</i>		0.020 lb	2	45 days	12 hours
+		+			
<i>isoxaflutole</i>		0.049 lb	27		
Corvus 2.63 SC	3.33 fl oz				
+	+	+			
<i>atrazine</i>)	1.0 qt	1.0 lb	5		

Comments: CORVUS is a RESTRICTED USE PESTICIDE. Apply CORVUS overtop on corn from spiking through the 2-leaf collar stage (V2). Controls *glyphosate- and ALS-resistant Palmer amaranth*, sicklepod, and prickly sida. Add 1.0 lb/A ATRAZINE to enhance control of weeds larger than 6 inches. Do not use COC or MSO with CORVUS applied to emerged corn. Do not apply tank-mixes of CORVUS with organophosphate or carbamate insecticides to emerged corn. Do not apply solo HPPD inhibitor postemergence herbicides (i.e., LAUDIS, CALLISTO, IMPACT) to corn that has been treated with CORVUS herbicide in the same growing season. Do not apply more than one application of CORVUS per 365-day period. Foliar applications of organophosphate or carbamate insecticides should not be made within 7 days of an application of CORVUS. If the water table (level of saturation) is less than 25 feet below the ground surface, do not use CORVUS on soils where the subsoil is loamy sand or sand (i.e., no clay subsoil). Certain corn hybrids are sensitive to ALS-inhibitor herbicides (MOA=2), consult your local seed dealer for more information. **Rainfast interval not indicated on label (suggest 1 hour minimum).**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>thiencarbazone</i>		0.013 lb	2	45 days	12 hours
+		+			
<i>tembotrione</i>		0.068 lb	27		
Capreno 3.45 SC	3.0 fl oz				
+	+	+			
<i>atrazine</i> 4 SC	1.0 qt	1.0 lb	5		

Comments: Apply CAPRENO overtop on corn from the 1 leaf collar stage (V1) up to the 6-leaf collar stage (V6). Controls *glyphosate- and ALS-resistant Palmer amaranth*, sicklepod, and prickly sida. Add 0.5 lb/A ATRAZINE to enhance control of weeds larger than 6 inches (*restricts broadcast application to corn 12 inches tall or less*). Add COC at 1 gal/100 gal of spray mix plus 1.5 qt/A of UAN or 1.5 lb/A of spray grade AMS. The use of NIS will decrease weed control performance. A sequential application of 3.0 fl oz can be made (wait a minimum of 14 days). Do not exceed 6.0 fl oz/A in a growing season. Do not use CAPRENO in the same season as LORSBAN, COUNTER, DYFONATE, or THIMET. Foliar applications of organophosphate or carbamate insecticides should not be made within 7 days of an application of CAPRENO. Certain corn hybrids are sensitive to ALS-inhibitor herbicide (MOA=2), consult your local seed dealer for more information. **Rainfast interval = 1 hour.**

<i>topramezone</i>		0.016-0.022 lb	27	45 days	12 hours
Armezon 2.8SC	0.75-1.0 fl oz				
Impact 2.8SC					
+	+	+	5		
<i>atrazine</i> 4 SC	1.0-2.0 pt	0.5-1.0 lb			

Comments: Apply *topramezone* overtop corn from emergence up to 12 inches tall. For improved foliar and residual weed control performance, it is recommended that ATRAZINE is tank mixed with IMPACT. For best results, add MSO at 1.0-1.5 gal per 100 gal of spray mix combined with a fertilizer solution of UAN at 1.25-2.5 gal per 100 gal of spray mix or spray grade AMS at 8.5-17 lb per 100 gal (use higher adjuvant rates for larger weeds or during periods when hot dry weather is expected). Do not apply more than 1.0 fl oz/A per season. Good to excellent control of *glyphosate- and ALS-resistant and Palmer amaranth* (less than 4" tall). **Rainfast interval = 1 hour.**

<i>topramezone</i>		0.016-0.022 lb	27	45 days	12 hours
+		+			
<i>atrazine</i>		0.25-0.33 lb	5		
Impact Z 4.26 SC	8.0-10.7 fl oz				

Comments: IMPACTZ is a RESTRICTED USE PESTICIDE. Apply IMPACTZ overtop corn from emergence up to 12 inches tall. Applications of IMPACTZ to emerged weeds require the addition of an adjuvant and a nitrogen fertilizer source to achieve optimum weed control. Add MSO (minimum of 80% oil and 14% emulsifiers) at 1.0-1.5 gal per 100 gal of spray mix with a nitrogen fertilizer solution of UAN at 1.25-2.5 gal per 100 gal of spray mix or a spray grade AMS at 8.5-17 lb per 100 gal. Use the higher adjuvant rate for application to larger weeds and during periods when hot dry weather is expected. Do not apply more than 10.7 fl oz/A per season. Good to excellent control of *glyphosate- and ALS-resistant and Palmer amaranth* (less than 4" tall). **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Field Corn (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>tompramezone</i> +		0.011-0.013 lb	27	45 days	12 hours
<i>dimethenamid-p</i> Armezon PRO 5.35EC	14-16 fl oz	0.57-0.66 lb	15		

Comments: Apply ARMEZON PRO overtop on corn from emergence until the 8-leaf growth stage (30 inches or less). Directed nozzles are recommended for corn 12 inches or above. For best results, add MSO or a COC at 1.0-1.5 gal per 100 gal of spray mix plus a fertilizer solution of UAN at 1.25-2.5 gal or spray grade AMS at 8.5-17 lb per 100 gal (use higher adjuvant rates for periods where hot dry weather is expected). Do not apply more than 28 fl oz/A of ARMEZON PRO in a single growing season. Do not graze treated corn forage, silage, fodder, or grain until 45 days after application. **Rainfast interval = 1 hour.**

<i>2,4-D amine 4S (various)</i>	0.5-1.0 pt	0.25-0.5 lb	4	7 days	48 hours
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Comments: Apply 2,4-D over-the-top to corn under 8" tall (to top of canopy). If corn is more than 8 inches tall, use drop nozzles to keep spray out of the whorls. Do tank mix with ATRAZINE, oil, or other adjuvants. Do not apply from tasseling to hard dough stage. Corn treated with 2,4-D may become temporarily brittle. Wind or cultivation may cause stem breakage during that time period. Make no more than one application per crop cycle. Do not apply more than 1.0 pt/A per application. Controls *glyphosate- and ALS-resistant Palmer amaranth*. Do not apply under conditions which favor drift onto nearby, sensitive crops. **Rainfast interval not indicated on label (suggest 1 hour).**

Postemergence Directed Herbicides for Weed Management in Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>ametryn</i> Evik 80WDG	0.75-2.0 lb	0.6-1.6 lb	5	30 days	12 hours
Comments: Apply EVIK as a postemergence directed spray after the smallest corn is at least 12 inches tall (measured from the highest leaf surface on free-standing plants). Apply in a minimum of 20 gallons of water per acre. Coverage is important for weed control performance. Add NIS at a rate of 2 qt per 100 gals of spray mixture. Do not spray over top of corn or injury will occur. Do not make more than one application per year. Do not apply within 3 weeks of tasseling.					
<i>carfentrazone</i> Aim 2EC	0.5-2.0 fl oz	0.008-0.031 lb	14	**	12 hours
Comments: Apply AIM as a postemergence directed spray from V8 to V14 growth stage. Add a COC at 1-2 gal per 100 gals, NIS at 1 qt per 100 gals, or MSO at 1-2 gal per 100 gals of spray mixture. Avoid directing the spray in the whorl of the plant. **Consult AIM product label regarding specific recommendations for preharvest intervals.					
<i>linuron</i> Linex 4L Lorox 50DF	1.25-3.0 pt 1.25-3.0 lb	0.63-1.5 lb	7	57 days	24 hours
Comments: Apply LINEX or LOROX as a postemergence directed spray when corn is at least 15 inches tall. Apply when there is sufficient height differential between weeds and the crop so that the directed spray thoroughly covers all weed foliage without contact of upper leaves or whorl of the corn by spray or drift. Add NIS at a rate of 2 qt per 100 gals of spray mixture. Spray to cover weeds no more than 3 to 4 inches tall. Use lower rate when weeds are no taller than 2 inches and higher rate for weeds up to 4 inches tall. Non-pressure nitrogen solution may be substituted for all or part of the water carrier.					
<i>paraquat 2S (various)</i>	1.0-2.0 pt	0.25-0.5 lb	22	7 days	12 hours
<i>paraquat 3S (various)</i>	0.7-1.3 pt	0.26-0.49 lb			
Comments: Apply PARAQUAT as a postemergence directed spray when corn is at least 10 inches tall. A hooded or shielded sprayer is recommended to minimize spray contact with corn foliage. Apply in a minimum of 10 gallons of water per acre. Coverage is important for weed control performance. Weeds 6 inches or taller may not be controlled. Add NIS at a rate of 1 qt per 100 gals of spray mixture. If using drop nozzles, arrange nozzles to spray no higher than lower 3 inches of the corn stalks. Corn plants shorter than 10 inches may be injured and not recover. For corn greater than 20 inches in height, arrange nozzles to spray no higher than the lower 1/3 of the corn stalks. Corn foliage sprayed will be injured but crop will recover and develop normally. Do not apply more than 3 applications of PARAQUAT post-directed per year.					
2,4-D amine 4S (various)	0.5-1.0 pt	0.25-0.5 lb	4	7 days	48 hours
Comments: Apply 2,4-D as a postemergence directed spray from 8 inches tall up to tasseling using drop nozzles to minimize contact with corn plant. If corn plants are growing rapidly, reduce 2,4-D rate to 0.5 pt to minimize crop injury potential.					

Harvest Aids for Field Corn

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i>		0.008-0.031 lb	14	7 days	12 hours
Aim 2EC	1.0-2.0 fl oz				

Comments: Apply AIM after physiological maturity (less than 35% moisture and black layer has formed). Desiccates annual morningglory and other weedy harvest impediments. Add a COC at 1-2 gal/100 gals, NIS at 1 qt/100 gals, or MSO at 1-2 gal/100 gals to the spray mix. Apply in a minimum of 10 gal/A.

<i>glyphosate (various)</i>	22-32 oz	0.75-1.13 lb ae	9	7 days	12 hours
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Comments: Apply GLYPHOSATE after physiological maturity (less than 35% moisture and the black layer has formed). Consult GLYPHOSATE product label for recommendations on adjuvants and other additives. Not recommended for use on corn grown for seed.

<i>paraquat 2S (various)</i>	1.2-2.0 pt	0.30-0.50 lb	22	7 days	24 hours
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<i>paraquat 3S (various)</i>	0.8-1.3 pt				
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Comments: Apply PARAQUAT in a minimum of 20 gallons of spray per acre by ground or 5 gallons of spray per acre by air after corn is mature. A black layer at the base of each kernel indicates maturity. Add a NIS at 1 qt/100 gal of spray solution. Use the higher rate to desiccate mature broadleaf weeds and grasses. Drought stressed plants can be difficult to kill and desiccation may not be complete. Make only 1 preharvest application of PARAQUAT per year.

<i>2,4-D amine 4S (various)</i>	1.0-3.0 pt	0.5-1.5 lb	4	7 days	48 hours
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Comments: Apply 2,4-D broadcast after the hard dough or dent growth stage to control weeds that interfere with harvest. Make no more than one application per crop cycle. Do not apply more than 3 pints per acre per application. **Do not apply if sensitive crops, such as cotton, is near the treated field.**

Post-Harvest Options for Weed Management (Managing Palmer seed production).

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>glyphosate (various)</i>	22-44 oz	0.75-1.5 lb ae	9	---	12 hours
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Comments: Apply GLYPHOSATE after corn harvest. Weak on large morningglory and glyphosate-resistant Palmer amaranth. Consult GLYPHOSATE product label for recommendations on adjuvants and other additives.

<i>paraquat 3S (various)</i>	1.33-2.0 pt	0.5-0.75 lb	22	---	12 hours
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<i>paraquat 2S (various)</i>	2.0-3.0 pt				
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Comments: Apply PARAQUAT in a minimum of 15 gallons of spray per acre by ground or 5 gallons of spray per acre by air after corn harvest. Add a NIS at 1 qt/100 gal of spray solution to the spray tank. Use the higher rate to desiccate mature broadleaf weeds and grasses. Drought stressed weeds are difficult to control, and desiccation may not be complete. A repeat application maybe necessary if weeds are large or under stress.

<i>2,4-D amine 4S (various)</i>	1.0-2.0 qt	1.0-2.0 lb	4	---	48 hours
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Comments: Apply 2,4-D amine broadcast after corn harvest to control broadleaf weeds and minimize seed production in the fall. Add GLYPHOSATE for control of grasses that are present. A second application may be necessary for large weeds, such as Palmer amaranth. Exercise caution when spraying 2,4-D amine broadcast due to potential drift onto nearby sensitive crops.

CORN INSECT CONTROL

Francis P. F. Reay-Jones, Extension Entomologist

Grain yield reductions and losses in grain quality due to insect pests are a constant problem in the Southeast. Control options include cultural practices to prevent or avoid injury, transgenic Bt corn, at-planting insecticides (including seed treatments), and foliar insecticides. Insect pressure varies greatly from field to field. Decisions concerning pest management options should therefore be made in careful consideration of the history of insect problems in each field where corn is to be planted.

Major insect pests of corn in South Carolina.

Insect	Description of feeding habit	Methods of control
Wireworms	Feed on planted kernels resulting in poor germination and stunted seedlings	Insecticide, tillage, control of winter weeds
Stink bugs	Feeds on growing point of developing plants, on developing ears prior to ear emergence, and individual kernels	Insecticide
Cutworms	Girdling of stalk at soil surface	Avoid planting corn on sod or weedy land, selected Bt hybrids, insecticides
Sugarcane beetles	Burrow into stalk above base of roots	Plant early and do not plant corn after sod
Billbugs	Chew into stalk and cause bud leaves to wilt and die	Crop rotation, weed removal in and around corn field, insecticides
Corn earworms	Feed on leaves in whorl and on ear tissue near ear tip	Insecticides, selected Bt hybrids, plant early
Fall armyworms	May feed on all above ground parts of corn plant	Bt hybrid, insecticides, plant and harvest early, control grassy weeds
Lesser cornstalk borers	Tunnel into corn seedling	Crop rotation and early planting, selected Bt hybrids, insecticides

Several types of Bt corn are available, each characterized by an 'event' (i.e. a successful insertion of the genetic package into a plant) and cry proteins. In a nutshell, there are Bt traits for above-ground pests and Bt traits for rootworms. Please refer to table below for efficacy of available products.

Bt traits for above-ground pests.

- Herculex I (event TC1507; protein Cry1F).
- Optimum Intrasect (events TC1507 and MON810; proteins Cry1F and Cry1Ab).
- Optimum Leptra (events TC1507, MON810, and MIR162; proteins Cry1F, Cry1Ab and Vip3Aa20).
- YieldGard CB (event MON810; protein Cry1Ab).
- Genuity VT Double Pro (event MON89034; proteins Cry1A.105 and Cry2Ab2).
- Agrisure Artesian 3010A (event Bt11; protein Cry1Ab).

- Agrisure GT/CB/LL (event Bt11; protein Cry1Ab).
- Agrisure Viptera 3110 (events MIR162 and Bt11; proteins Vip3Aa20 and Cry1Ab).
- Agrisure Viptera 3220 (events MIR162 and TC1507; proteins Vip3Aa20, Cry1Ab and Cry1F)
- PowerCore (events MON89034 and TC1507; proteins Cry1A.105, Cry2Ab2, and Cry1F)
- Trecepta (events MON89034 and MIR162; proteins Cry1A.105, Cry2Ab2, and Vip3Aa20)

All products provide excellent control of stalk borers (European corn borer, southern cornstalk borer). The activity in seedling and whorl stage is greater in Herculex I, which provides good early season control of cutworms, lesser corn stalk borer, and fall armyworm. YieldGard CB and Agrisure CB/LL have fair activity for corn earworm infestations in corn ears, whereas control with Herculex I is poor. The more recent Genuity VT Double Pro was the first Bt corn trait to express two Bt toxins to control above ground Lepidopteran pests. Genuity VT Double Pro provides very good control of fall armyworm, while control of corn earworm is inconsistent, though can be better than single toxin Bt products. The Vip3Aa20 toxin that is included in Agrisure Viptera, Optimum Leptra and in Trecepta hybrids is the only toxin that provides excellent control of corn earworm. These hybrids may be particularly useful in late planted and no-till corn.

Bt traits for rootworms.

- Herculex RW (event DAS59122-7, protein Cry34/35Ab1).
- YieldGard Rootworm (event MON863, protein Cry3Bb).
- YieldGard VT Rootworm/RR2 (event MON88017, protein Cry3Bb).
- Agrisure RW (event MIR604, protein mCry3A).

All products provide control of western corn rootworms (but no control of grubs and wireworm). Western corn rootworms are not currently widespread pests in South Carolina, and these products should generally not be needed.

Stacked Bt traits for above-ground pests and rootworms.

- Optimum Intrasect XTRA (events TC1507, MON810, and DAS59122-7, cry proteins Cry1F, Cry1Ab, and Cry34/35Ab1).
- YieldGard VT Triple (events MON810 and MON88017, cry proteins Cry1Ab and Cry3Bb1).
- Agrisure CB/LL/RW (events Bt11 and MIR604, cry proteins Cry1Ab and mCry3A).
- Agrisure 3000 GT, Agrisure Artesian 3011A (events Bt11, and MIR604, cry proteins Cry1Ab and mCry3A).
- Agrisure Viptera 3111 (events MIR162, Bt11 and MIR604, vip protein Vip3A and cry proteins Cry1Ab and mCry3A).
- Genuity VT Triple Pro (events MON89034 and MON88017, cry proteins Cry1A.105, Cry2Ab2 and Cry3Bb1).
- Powercore (events MON89034 and TC1507, cry proteins Cry1A.105, Cry2Ab2, and Cry1F).
- SmartStax or Genuity SmartStax (events MON89034, MON88017, TC1507 and DAS59122, cry proteins Cry1A.105, Cry2Ab2, Cry3Bb, Cry1F, and Cry34/35Ab1).

These products combine the cry proteins (and efficacy) of the above-ground pest and rootworm Bt corn traits.

*Refuge requirements for Bt corn for above-ground pests in Cotton Belt (**see dealers for complete refuge requirements**)*

- For YieldGard Corn Borer, Agrisure GT/CB/LL, Agrisure Artesian 3010A, Herculex I: 50% of corn on a farm can be planted as Bt corn.

- Genuity VT Double Pro, Agrisure Viptera 3110, Agrisure Viptera 3220, Optimum Intrasect, Optimum Leptra, PowerCore: 20% of corn on a farm can be planted as Bt corn.
- Blocks can be internal (within Bt field) or external (in separate field within ½ mile of Bt field to maximize random mating; ¼ mile is however preferred).
- In field strips: at least 4 rows wide to reduce effect of larval movement (6 rows preferred)
- Refuge can be sprayed with any insecticide except Bt products

*Refuge requirements for Bt corn for rootworms in Cotton Belt (**see dealers for complete refuge requirements**)*

Bt corn for rootworm has specific regulations that differ from stalk borer Bt corn. The major difference for rootworm Bt corn is that refuges must be either adjacent to or within the Bt field, rather than within ¼ mile of the Bt field for stalk borer Bt corn. This is due to the poor flight ability of corn rootworm adults.

*Refuge requirements for stacked Bt corn for above-ground pests and rootworms in Cotton Belt (**see dealers for complete refuge requirements**)*

- For YieldGard VT Triple, Agrisure CB/LL/RW, Agrisure GT 3000, Agrisure Artisan 3011A: 50% of corn on a farm can be planted as Bt corn.
- Genuity VT Triple PRO, SmartStax, Genuity SmartStax, Agrisure Viptera 3111, Optimum Intrasect XTRA: 20% of corn on a farm can be planted as Bt corn.

2 options for the refuge:

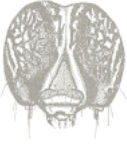

- o Common rootworm/corn borer refuge
- o Discrete rootworm and corn borer refuges
- For common refuge and discrete rootworm refuge: use adjacent field, block perimeter, or in-field strip.
- For discrete corn borer refuge: separate fields can be used in addition to other refuge options.
- For shared refuge and discrete rootworm refuge: refuges must be adjacent to or within field.
- For discrete corn borer refuge: separate refuges must be within 1/2 mile (but 1/4 mile preferred).
- At least 4 rows (for discrete corn borer refuges, at least 6 rows are recommended).
- Refuge can be sprayed with any insecticide except Bt products.



Relative Efficacy of Various Bt Corn Products¹. (IPM-0428, Alabama Cooperative Extension Service)¶



Product Trade Name (Abbreviation)⌘	Bt Protein(s)⌘	Amount of Insect Control ¹ ⌘						Herbi-cide tolera-nce ⁵ ⌘	Required refuge in the South ⁶ ⌘	Event(s)⌘
		Corn Ear-worm (ear)⌘	Fall Army-worm (whorl)⌘	Corn borers ² (stalk)⌘	Black cutworm (seed-ling)⌘	Lesser Corn-stalk Borer ³ ⌘	Corn root-worm ⁴ (roots)⌘			
		-----Above-ground-----⌘								
Agrisure Products⌘										
Agrisure Artesian 3010A⌘	Cry1Ab⌘	P-F⌘	F-G⌘	E⌘	P⌘	G⌘	-⌘	GTLL⌘	50%⌘	Bt11, GA21⌘
Agrisure GT/CB/LL⌘	Cry1Ab⌘	P-F⌘	F-G⌘	E⌘	P⌘	G⌘	-⌘	GTLL⌘	50%⌘	Bt11, GA21⌘
Agrisure 3000GT, Agrisure Artesian 3011A⌘	Cry1Ab, mCry3A⌘	P-F⌘	F-G⌘	E⌘	P⌘	G⌘	F-G⌘	GT LL⌘	50%⌘	Bt11, MIR604, GA21⌘
Agrisure Viptera 3110⌘	Vip3Aa20, Cry1Ab⌘	E⌘	E⌘	E⌘	G⌘	G⌘	-⌘	GT LL⌘	20%⌘	MIR162, Bt11, GA21⌘
Agrisure Viptera 3111⌘	Vip3Aa20, Cry1Ab, mCry3A⌘	E⌘	E⌘	E⌘	G⌘	G⌘	F-G⌘	GT LL⌘	20%⌘	MIR162, Bt11, MIR604, GA21⌘
Agrisure Viptera 3220⌘	Vip3Aa20, Cry1Ab, Cry1F⌘	E⌘	E⌘	E⌘	VG⌘	VG⌘	-⌘	GT LL⌘	20%⌘	MIR162, Bt11, TC1507, GA21⌘
Herculex and Optimum Products⌘										
Herculex I (HX1) or (HR)⌘	Cry1F⌘	P⌘	G-VG⌘	E⌘	G⌘	G⌘	-⌘	LL⌘	50%⌘	TC1507⌘
Optimum Intrasect (YHR)⌘	Cry1F, Cry1Ab⌘	F⌘	VG⌘	E⌘	VG⌘	VG⌘	-⌘	LL RR2⌘	20%⌘	TC1507, MON810⌘
Optimum Intrasect XTRA (YXR)⌘	Cry1F, Cry1Ab, Cry34Ab1/Cry35Ab1⌘	F⌘	VG⌘	E⌘	VG⌘	VG⌘	E⌘	LL RR2⌘	20%⌘	TC1507, MON810, DAS-59122-7⌘
Optimum Leptra (VYHR)⌘	Cry1F, Cry1Ab, Vip3Aa20⌘	E⌘	E⌘	E⌘	VG⌘	VG⌘	-⌘	LL RR2⌘	20%⌘	TC1507, MON810, MIR162⌘
YieldGard Products⌘										
YieldGard Corn Borer (YGCB)⌘	Cry1Ab⌘	P-F⌘	F-G⌘	E⌘	P⌘	G⌘	-⌘	-⌘	50%⌘	MON810⌘
YieldGard VT Triple (VT3)⌘	Cry1Ab, Cry3Bb1⌘	P-F⌘	F-G⌘	E⌘	P⌘	G⌘	VG⌘	RR2⌘	50%⌘	MON810, MON88017⌘
Genuity/SmartStax Products⌘										
Genuity VT Double PRO (GENVT2P), Genuity Drought Gard VT Double PRO (GENDGVT2P)⌘	Cry1A.105, Cry2Ab2⌘	P-F⌘	E⌘	E⌘	P⌘	VG⌘	-⌘	RR2⌘	20%⌘	MON89034, NK603⌘
Genuity VT Triple PRO (GENVT3P)⌘	Cry1A.105, Cry2Ab2, Cry3Bb1⌘	P-F⌘	E⌘	E⌘	P⌘	VG⌘	VG⌘	RR2⌘	20%⌘	MON89034, MON88017⌘
PowerCore (Dow)⌘	Cry1A.105, Cry2Ab2, Cry1F⌘	F-G⌘	E⌘	E⌘	G⌘	VG⌘	-⌘	LL RR2⌘	20%⌘	MON89034, TC1507, NK603⌘
SmartStax (SSX, Dow) or Genuity SmartStax (GENSS, Monsanto)⌘	Cry1A.105, Cry2Ab2, Cry1F, Cry3Bb1, Cry34Ab1/Cry35Ab1⌘	F-G⌘	E⌘	E⌘	G⌘	VG⌘	E⌘	LL RR2⌘	20%⌘	MON89034, TC1507, MON88017, DAS-59122-¶7⌘
Trecepta⌘	Cry1A.105, Cry2Ab2, Vip3A20⌘	E⌘	E⌘	E⌘	VG⌘	VG⌘	-⌘	RR2⌘	20%⌘	MON89034, MIR162⌘

¹E = excellent, VG = very good, G = good, F = fair, P = poor. Excellent usually means better than 95 percent control. Poor means less than about 30% control. ²Southwestern corn borer, European corn borer, and sugarcane borer, and others. ³Lepidopteran Bt traits do not specifically list lesser cornstalk borer (LCB) as a target pest. ⁴Bt rootworm traits target western corn rootworm larvae (CRW), which occurs in areas such as north Alabama and north Georgia. These traits are not effective against southern corn rootworm. ⁵GT = Glyphosate tolerant; LL = Liberty Link (glufosinate tolerant); RR2 = Roundup Ready 2 (glyphosate tolerant). ⁶See product Insect Resistance Management (IRM) documentation from the seed companies for more details. ⁷Resistance to Cry1F has been reported in some areas of the Southeast. Adapted from D. Buntin and K. Flanders, 2014, Bt Corn Products for the Southeastern United States. Based on input from entomologists attending the annual Southern Field Crops Management Seminar. ¶


INSECTICIDES AT PLANTING

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Armyworm (fall armyworm) 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn.
Billbugs (seed treatment)	Clothianidin PONCHO 1250 or ACCELERON	1.25 mg (ai)/seed	-	-	-	Seed treatment
	Thiamethoxam CRUISER 5FS 1250	1.25 mg (ai)/seed	12	-	-	Seed treatment
Billbugs (at planting insecticide)	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
Chinch bug (seed treatment) 	Clothianidin PONCHO 250 or ACCELERON	0.25 mg (ai)/seed	-	-	-	Seed treatment
	PONCHO 1250 or ACCELERON	1.25 mg (ai)/seed	-	-	-	
	Thiamethoxam CRUISER 5FS 250 CRUISER 5FS 1250	0.25 mg (ai)/seed	12	-	-	Seed treatment
Chinch bug (at planting insecticide)	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
R = Restricted use pesticide; REI=re-entry interval (hrs); PHI=pre-harvest interval (days); PGI=pre-grazing interval (days)						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Chinch bug (at planting insecticide) (cont.)	Tefluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
Corn earworm 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn.
Cutworm 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn.
Cutworm (at planting insecticide)	Bifenthrin CAPTURE 2EC R	0.15-0.30 oz/ 1000 ft of row	12	30	30	
	CAPTURE 1.15G R	6.4-8 oz/ 1000 ft	12	30	30	
	Esfenvalerate ASANA XL R	0.45 oz/ 1000 ft of row	12	21	-	Apply in band, T-band, or in furrow.
	Gamma-cyhalothrin PROAXIS R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in band, T-band, or in furrow.
	Lambda-cyhalothrin WARRIOR R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in band, T-band, or in furrow
	Permethrin PERMETHRIN 3.2EC R	4-8 oz/ac or 0.3-0.6 oz/ 1000 ft of row.	12	30	0 (green) 30 (fodder)	Apply in band, T-band, or in furrow
POUNCE 25 WP R	6.4-9.6 oz/ac or 0.5-0.75 oz/1000 ft of row	12	30	0 (green) 30 (fodder)		
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Cutworm (at planting insecticide) (cont.)	Permethrin POUNCE 1.5G R	8 oz/1000 ft of row	12	30	0 (green) 30 (fodder)	Apply in band, T-band, or in furrow
	Terbufos COUNTER 15G R	6 to 8 oz/1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow. <i>Suppression only.</i>
	Zeta-cypermethrin MUSTANG MAX R	0.16 oz /1000 ft of row	12	30	60	
European corn borer 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn.
Lesser corn stalk borer 	Transgenic Bt corn (see table above for details)	Insecticide in plant	-	-	-	See dealers for refuge requirements for Bt corn. Herculex I, Herculex Xtra, and Genuity Smartstax provide good-excellent control; other Bt products will provide poor-good control.
Lesser corn stalk borer (at planting insecticide)	Gamma-cyhalothrin PROAXIS R	0.66 oz/1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Lambda-cyhalothrin WARRIOR R	0.66 oz/1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Terbufos COUNTER 15G R	6 to 8 oz/1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow. <i>Suppression only.</i>
	Tefluthrin FORCE 3G R	4 to 5 oz/1000 ft of row	0	-	-	Apply as band or T-band.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

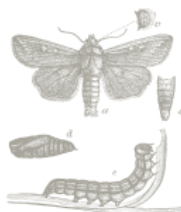
INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Wireworm (seed treatment)	Clothianidin PONCHO 250 or ACCELERON	0.25 mg (ai)/seed	-	-	-	Seed treatment
	PONCHO 1250 or ACCELERON	1.25 mg (ai)/seed	-	-	-	
	Thiomethoxam CRUISER 5FS 250	0.25 mg (ai)/seed	12	-	-	
	CRUISER 5FS 1250	1.25 mg (ai)/seed	12	-	-	
Wireworm (at planting insecticide)	Bifenthrin CAPTURE 2EC R	0.15-0.30 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band. Or in furrow.
	Bifenthrin CAPTURE 1.15G R	6.4-8 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band. Apply in furrow.
	CAPTURE 1.15G R	3.2-8 oz/ 1000 ft of row				
	Gamma-cyhalothrin PROAXIS R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac. <i>Suppression only.</i>
	Lambda-cyhalothrin WARRIOR R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Permethrin PERMETHRIN 3.2EC R	0.3 oz/ 1000 ft of row	12	30	0 (green) 30 (fodder)	Apply in furrow, band or T-band using at least a 4 inch band.
	Permethrin POUNCE 1.5G R	8 oz/ 1000 ft of row	12	30	0 (green) 30 (fodder)	
	Phorate THIMET 20G	4.5-6 oz/ 1000 ft of row	48	30	30	Apply either in 7 inch band.
	Terbufos COUNTER 15G R	6 to 8 oz/1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.	
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Seed corn maggot (seed treatment) 	Clothianidin PONCHO 250 or ACCELERON	0.25 mg (ai)/seed	-	-	-	Seed treatment
	PONCHO 1250 or ACCELERON	1.25 mg (ai)/seed	-	-	-	
	Thiamethoxam CRUISER 5FS 250	0.25 mg (ai)/seed	12	-	-	Seed treatment.
CRUISER 5FS 1250	1.25 mg (ai)/seed	12	-	-		
Seed corn maggot (at planting insecticide)	Bifenthrin CAPTURE 2EC R	0.15-0.30 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band. Or in furrow.
	CAPTURE 1.15G R	6.4-8 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band. Apply in furrow.
	Gamma-cyhalothrin PROAXIS R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Lambda-cyhalothrin WARRIOR R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Permethrin PERMETHRIN 3.2EC R	0.3 oz/ 1000 ft of row	12	30	0 (green) 30 (fodder)	Apply in furrow, band or T- band using at least a 4 inch band.
	POUNCE 3.2EC R	0.3 oz/ 1000 ft of row	12	30	0 (green) 30 (fodder)	
	Permethrin POUNCE 1.5G R	8 oz/ 1000 ft of row	12	30	0 (green) 30 (fodder)	
	Phorate THIMET 20G	4.5-6 oz/ 1000 ft of row	48	30	30	Apply either in 7 inch band.


R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Seed corn maggot (at planting insecticide) (cont.)	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
Southern corn rootworm larvae (seed treatment)	Clothianidin PONCHO 250 or ACCELERON	0.25 mg (ai)/seed	-	-	-	Seed treatment
	PONCHO 1250 or ACCELERON	1.25 mg (ai)/seed	-	-	-	
	Thiamethoxam CRUISER 5FS 250	0.25 mg (ai)/seed	12	-	-	Seed treatment.
	CRUISER 5FS 1250	1.25 mg (ai)/seed	12	-	-	
Southern corn rootworm larvae (at planting insecticide)	Bifenthrin CAPTURE 2EC R	0.30 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band. Or in furrow.
	Bifenthrin CAPTURE 1.15G R	6.4-8 oz/ 1000 ft of row	12	30	30	Apply in 5-7 inch T-band.
		3.2-8 oz/ 1000 ft of row				Apply in furrow.
	Gamma-cyhalothrin PROAXIS R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Lambda-cyhalothrin WARRIOR R	0.66 oz/ 1000 ft of row	24	21	1 (green) 21 (fodder)	Apply in 5-7 inch T-band, or in furrow. Use a minimum of 3 gal/ac.
	Phorate THIMET 20G	4.5-6 oz/ 1000 ft of row	48	30	30	Apply either in 7 inch band.
	Terbufos COUNTER 15G R	6 to 8 oz/ 1000 ft of row	48	60	30	Apply either in 7 inch band or in furrow
	Telfluthrin FORCE 3G R	4 to 5 oz/ 1000 ft of row	0	-	-	Apply as band or T-band.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						


POST EMERGENCE INSECTICIDES

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground.
	CAPTURE 1.15G R	3.5-8.7 oz /ac	12	30	30	Apply broadcast when insects first appear.
	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb/ ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	4F, XLR Plus	1-2 qts/ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	Chlorantraniliprole PREVATHON	14-20 oz /ac	4	14	-	
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz/ ac	12	21	-	
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz /ac	24	21	1 (green) 21 (fodder)	For control of 1 st and 2 nd instars only.
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz /ac	24	21	1 (green) 21 (fodder)	Use higher rates for large larvae.
Methomyl LANNATE LV R	0.75-1.5 pts/ac	48	21 (ears)	3 (green) 21 (fodder)		
LANNATE SP R	0.25-0.5 lbs/ac	48	21 (ears)	3 (green) 21 (fodder)		
Methoxyfenozide INTREPID 2F	4-16 oz/ac	4	21	21	Use only for true armyworm. Apply at first sign of egg hatch.	


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INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Armyworms (cont.)	Permethrin PERMETHRIN 3.2EC R	4-6 oz/ac	12	30	0 (green) 30 (fodder)	Apply at first sign of egg hatch.
	POUNCE 25 WG R	6.4-9.6 oz/ac	12	30	0 (green) 30 (fodder)	
	Permethrin POUNCE 1.5G R	6.7-13.3 oz /ac	12	30	0 (green) 30 (fodder)	Apply at first sign of egg hatch.
	Spinosad BLACKHAWK	1.1-3.3	4	28	1 (grain) 3 (fodder)	Apply at peak egg hatch of each generation.
	Zeta-cypermethrin MUSTANG MAX R	3.2-4.0 oz /ac	12	30	60	
Chinch bug 	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground.
	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb /ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	Use ground equipment to apply at least 20 gal/ac of water and direct spray towards stalk
	4F, XLR Plus	1-2 qts/ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	0 (green) 12 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	Spray needs to be directed towards base of plant.
	Gamma-cyhalothrin PROAXIS R	3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	3.2-4.0 oz /ac	12	30	60	

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INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Corn earworm 	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz/ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground.
	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb /ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	4F, XLR Plus	1-2 qts/ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	Chlorantraniliprole PREVATHON	14-20 oz /ac	4	14		
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz/ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	Spray needs to be directed towards base of plant.
	Gamma-cyhalothrin PROAXIS R	1.92-3.2 oz /ac	24	21	1 (green) 21 (fodder)	Use before larvae enter stalk or ear.
	Lambda-cyhalothrin WARRIOR R	1.92-3.2 oz /ac	24	21	1 (green) 21 (fodder)	Use before larvae enter stalk or ear.
	Methomyl LANNATE LV R	0.75-1.5 pts /ac	48	21 (ears)	3 (green) 21 (fodder)	
	LANNATE SP R	0.25-0.5 lbs /ac	48	21 (ears)	3 (green) 21 (fodder)	
	Permethrin PERMETHRIN 3.2EC R	4-6 oz/ac	12	30	0 (green) 30 (fodder)	Apply just before silking.
	POUNCE 25 WG R	6.4-9.6 oz/ac	12	30	0 (green) 30 (fodder)	
	Spinosad BLACKHAWK	2.2-3.3	4	28	1 (grain) 3 (fodder)	Apply at peak egg hatch of each generation.
Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz /ac	12	30	60		


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INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
	Beta-cyfluthrin BAYTHROID XL R	0.8-1.6 oz /ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground.
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	2.5 lb/ac 2 qts/ac	12 12	14 (silage) 48 (ears) 14 (silage) 48 (ears)	14 (green) 48 (fodder) 14 (green) 48 (fodder)	Apply in 12-inch band over the row using sufficient volume of water to obtain thorough coverage. For broadcast, use at least 20 gal/ac of water by ground
	Deltamethrin DELTA GOLD 1.5EC R	1-1.5 oz/ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	
	Gamma-cyhalothrin PROAXIS R	1.92-3.20 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	1.92-3.20 oz/ac	24	21	1 (green) 21 (fodder)	
	Methomyl LANNATE LV R LANNATE SP R	1.5 pts/ac 0.5 lbs/ac	48 48	21 (ears) 21 (ears)	3 (green) 21 (fodder) 3 (green) 21 (fodder)	
	Permethrin PERMETHRIN 3.2EC R POUNCE 25 WG R	4-6 oz/ac 6.4-9.6 oz/ac	12 12	30 30	0 (green) 30 (fodder) 0 (green) 30 (fodder)	
	Permethrin POUNCE 1.5G R	6.7-13.3 oz/ac	12	30	0 (green) 30 (fodder)	
Zeta-cypermethrin MUSTANG MAX R	1.28-2.8 oz /ac	12	30	60		


R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval


INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
European corn borer	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground. Apply broadcast at or just before egg hatch.
	CAPTURE 1.15G R	3.5-8.7 oz /ac	12	30	30	
	Carbaryl SEVIN 80S, 80WSP	1.875-2.5 lb/ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	Use ground equipment to apply at least 15 gal/acre of water and direct spray towards stalk.
	4F, XLR Plus	1.5-2 qts /ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	Chlorantraniliprole PREVATHON	14-20 oz /ac	4	14		
	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	Application must be made before larvae enter plant.
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	7.8-9.6 oz /ac	12	21	-	Spray when eggs are in blackhead stage or before larvae enter whorl.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz /ac	24	21	1 (green) 21 (fodder)	Use before larvae enter stalk or ear.
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz /ac	24	21	1 (green) 21 (fodder)	Use before larvae enter stalk or ear.
Methomyl LANNATE LV R	0.75-1.5 pts/ac	48	21 (ears)	3 (green) 21 (fodder)		
LANNATE SP R	0.25-0.5 lbs/ac	48	21 (ears)	3 (green) 21 (fodder)		

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval


INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
European corn borer (cont.)	Methoxyfenozide INTREPID 2F	4-16 oz/ac	4	21	21	Apply at first sign of egg hatch. Direct application at whorl for early season (1 st generation). Apply as broadcast over row mid and late season.
	Permethrin PERMETHRIN 3.2EC R	4-6 oz/ac	12	30	0 (green) 30 (fodder)	
	POUNCE 25 WG R	6.4-9.6 oz/ac	12	30	0 (green) 30 (fodder)	
	Permethrin POUNCE 1.5G R	6.7-13.3 oz /ac	12	30	0 (green) 30 (fodder)	
	Spinosad BLACKHAWK	1.1-3.3	4	28	7	Apply at peak egg hatch of each generation.
	Zeta-cypermethrin MUSTANG MAX R	2.72-4.0 oz /ac	12	30	60	
Flea beetle 	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground
	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb /ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	4F, XLR Plus	1-2 qts/ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	Beta-cyfluthrin BAYTHROID XL R	0.8-1.6 oz /ac	12	21	0 (green) 21 (fodder)	Beta-cyfluthrin BAYTHROID XL R
	Deltamethrin DELTA GOLD 1.5EC R	1.0-1.5 oz/ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	

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INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Flea beetle (cont.)	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Permethrin PERMETHRIN 3.2EC R	4-6 oz/ac	12	30	0 (green) 30 (fodder)	
	POUNCE 25 WG R	6.4-9.6 oz/ac	12	30	0 (green) 30 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	2.72-4.0 oz /ac	12	30	60	
Grasshoppers 	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast in at least 10 gal/ac of water by ground.
	Beta-cyfluthrin BAYTHROID XL R	2.1-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
	Deltamethrin DELTA GOLD 1.5EC R	1.0-1.5 oz /ac	12	21	12 (green) 21 (fodder)	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	For 1 st and 2 nd instar nymph, use 3.9-5.8 oz/ac. Timing and good coverage is critical. Beyond 2 nd instar, use 5.8- 9.6 oz/ac
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	Lambda- cyhalothrin WARRIOR R
	Zeta-cypermethrin MUSTANG MAX R	2.72-4.0 oz /ac	12	30	60	Zeta- cypermethrin MUSTANG MAX R
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Lesser cornstalk borer 	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
Southern corn rootworm beetles	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast.
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.25-2.5 lb /ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
		1-2 qts/ac	12	14 (silage) 48 (ears)	14 (green) 48 (fodder)	
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	12 (green) 21 (fodder)	Use at least 5 gal/ac for ground application.
	Esfenvalerate ASANA XL R	5.8-9.6 oz /ac	12	21	-	Apply at first sign of silk feeding.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
Methomyl LANNATE LV R LANNATE SP R	0.75-1.5 pts/ac	48	21 (ears)	3 (green) 21 (fodder)		
	0.25-0.5 lbs/ac	48	21 (ears)	3 (green) 21 (fodder)		

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Southern corn rootworm beetles (cont.)	Permethrin PERMETHRIN 3.2EC R	4-6 oz/ac	12	30	0 (green) 30 (fodder)	
	POUNCE 25 WG R	6.4-9.6 oz/ac	12	30	0 (green) 30 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	3.2-4.0 oz /ac	12	30	60	Use at least 10 gal/ac for ground application.
Stink bugs 	Beta-cyfluthrin BAYTHROID XL R	1.6-2.8 oz /ac	12	21	0 (green) 21 (fodder)	
	Bifenthrin CAPTURE 2EC R	2.1-6.4 oz /ac	12	30	30	Apply broadcast.
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.9 oz /ac	12	21	12 (green) 21 (fodder)	Use at least 5 gal/ac for ground application.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Lambda-cyhalothrin WARRIOR R	2.56-3.84 oz/ac	24	21	1 (green) 21 (fodder)	
	Zeta-cypermethrin MUSTANG MAX R	2.72-4.0 oz /ac	12	30	60	Use at least 10 gal/ac for ground application.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval						

PRE-MIXED or CO-PACKAGED INSECTICIDES						
BRAND NAME	RATE	REI	PHI	PGI	COMMENTS	
HERO (Bifenthrin, zeta-cypermethrin)	2.6-10.3 oz/ac	12	30	30 (green) 60 (forage)		
BESIEGE (lambda-cyhalothrin, chlorantraniliprole)	5-10 oz/ac	24	21	1 (green) 21 (fodder)		

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval

FOLIAR DISEASE CONTROL IN FIELD CORN

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In South Carolina corn is subject to many seedling and foliar diseases as well as stalk rots and ear rots. Most of these diseases are caused by various species of fungi. Fortunately, several tools are available to combat these fungi including altering tillage practices, and selection of appropriate crop rotations, resistant hybrids, and fungicides. The challenge is to predict the disease(s) that threaten your crop and choose the combination of control measures that will provide the most economical level of control.

SEEDLING DISEASES & SEED ROTS:

Seedling diseases and seed rots are most severe when soil temperatures are below 55°F and soils are wet. These conditions are more common in Piedmont soils than Coastal Plain soils due to higher clay content and poorer drainage. Most corn hybrids sold in South Carolina are commercially treated with very efficacious fungicides that will control the levels of disease normally encountered. As with any disease, monocropping for multiple years will increase the risk of disease. Delaying planting until soil temperatures are consistently above 55°F at a 2-inch depth will improve germination and emergence and lower the risk of soilborne seedling diseases. Applying supplemental seed treatment fungicides to seed with treated with a standard commercial seed treatment package is normally not warranted.

FOLIAR DISEASES:

Bacterial diseases: Most of the foliar diseases of corn are caused by fungi. One exception is Holcus leaf spot which is caused by the bacterium *Pseudomonas syringae* pv. *syringae*. This bacterium overwinters in crop residue and commonly appears a few days after a heavy rain. Fungicide sprays are ineffective versus a bacterial disease. Paraquat drift on corn is often mistaken for this disease due to their similar symptoms.

Viral diseases: These are common on corn in South Carolina. The most common virus diseases on corn in South Carolina are Maize chlorotic dwarf virus (MCDV) and Maize dwarf mosaic virus (MDMV). Maize chlorotic dwarf virus overwinters on johnsongrass, sorghum, and other grasses. It is transmitted by one species of leafhopper. Maize dwarf mosaic virus overwinters in johnsongrass and is transmitted by aphids. Hybrids with resistance or tolerance are available to both viruses. Fungicide applications are ineffective against any virus.

Fungal diseases: The majority of foliar diseases of corn are caused by fungi. The most unusual of these fungal diseases is Physoderma brown spot (PBS) is caused by *Physoderma maydis*. This disease is becoming more common in South Carolina and United States in recent years. However, incidence of this disease seemed to be lower in South Carolina in 2022 than 2021. What makes PBS unusual is that most fungal pathogens of corn produce only immobile spores. PBS produces mobile spores that can swim in moisture. The fungus overwinters in debris from previous corn crops in the field. It infects the corn plant while leaves are still in whorls. To control this early season infection, fungicide treatments must be applied at planting or just after planting. Fungicides applied at tasseling will be too late to control damage to the lower stalks and leaves caused by PBS. No resistance to PBS is available. Rotations with any crop other than corn will help reduce overwintering by PBS in debris. Fungicides must be applied at planting or just after planting. XYWAY LFR FUNGICIDE (flutriafol) is the only fungicide labeled for use at planting on corn. Early applications of XYWAY often do not control later season foliar diseases and stalk rots.

Northern corn leaf blight: In some years NCLB can be quite common in South Carolina. It normally appears at or after pollination. This fungus overwinters on corn residue from previous crops. Leaf symptoms include large cigar-

shaped lesions 1- to 6-inches long that are gray green in color. Mature lesions appear tan with dark zones of fungal spores. There are many resistant hybrids available and along with rotation to crops other than corn to reduce overwintering on crop debris, they are the primary control method. Most fungicides applied at tasseling are effective in limiting yield losses due to NCLB. However, there are at least 5 races of NCLB that vary in pathogenicity. Most races are mild pathogens. One complicating factor with NCLB is that some populations of the fungus are resistant to some fungicides.

Common & Southern rust: In South Carolina, common rust is seen less frequently than Southern rust, which is caused by a different fungus. Symptoms of common rust include pustules predominately on the upper leaf surface, but pustules can also occur on the lower leaf surface. Initially, pustules produce cinnamon-brown urediniospores but later they produce golden brown to black teliospores which give the pustules a brownish-black appearance. Typically, common rust has very little effect on yield and normally fungicide sprays are not needed. Unlike most of the foliar diseases of corn which overwinter on crop debris, common rust overwinters in live plants in tropical areas. Spores are windborne and are progressively blown northward into the southern United States. High moisture but relatively low temperatures between 61° and 77° F favor disease development. These conditions often do not occur in the southern United States, so disease development is often minimal. Resistant varieties are available, and fungicides provide effective control.

Southern rust normally is not a problem in South Carolina, but in years where conditions are right it can be serious on late-planted corn. Symptoms of Southern rust include small circular to oval pustules that are light cinnamon to orange in color. Normally they are on the upper leaf surface and only rarely occur on the bottom leaf surface. They can occur on leaves, stalks, sheaths, and husks. Southern rust inoculum blows in from states south and southwest of South Carolina. Normally symptoms are not present on leaves in South Carolina until mid-summer. Conditions that favor the disease include temperatures of 80° to 90° F and high humidity, heavy dew, rainfall, or active hurricanes. Disease development can be rapid in those conditions. Management of Southern rust begins with choosing a variety that is less susceptible to rust and being prepared to spray a fungicide if needed. Normally these fungicides should be applied at VT/R1 to act as a preventive spray.

Gray leaf spot: GLS is similar to Northern corn leaf blight and Southern corn leaf blight in that it overwinters in crop debris. Spores produced on debris on the soil surface are spread by wind and splashing rain. Early season symptoms include small necrotic spots with a yellow halo. Mature lesions are tan to gray and expand linearly between the leaf veins creating a rectangular-shaped lesion. If moist warm (72° to 86° F) conditions persist GLS can spread rapidly through the upper foliage and at times may kill full-size plants. Management starts with avoiding monocropping corn. In fields where minimum tillage is employed resistant varieties should be grown. Foliar fungicides may be required, especially if a susceptible variety is monocropped in a field with minimum tillage.

Southern corn leaf blight: Symptoms of SCLB include leaf lesions that vary in shape, color, and size according to the hybrid grown. In general, they are oval to elongated tan-colored lesions with yellow-green borders. SCLB lesions may occur on the foliage, sheaths, stalks, and husks. The SCLB fungus infects many wild grasses. Management of SCLB is achieved primarily by growing resistant hybrids. Tillage and rotation to a non-host crop will reduce overwinter survival of the fungus on crop debris. Fungicides can be effective but are rarely needed specifically for SCLB in South Carolina.

Stalk rots: Several species of fungi cause stalk rots and are very common in most areas where corn is grown. However, in most cases, the yield losses they cause are relatively low. Anthracnose stalk rot, Charcoal rot, Diplodia stalk rot, Fusarium stalk rot, and Gibberella crown rot and stalk rot can all occur in South Carolina. Like many of the foliar fungal diseases, the primary inoculum for stalk rots is present on crop debris from the previous year. Monocropping corn in a minimum tillage scenario can result in higher levels of stalk rots than in a field that has been rotated to a crop other than corn. Any problem that stresses the corn plant during the growing season can increase

the severity of stalk rots. If stalk rots are present, they cannot be eliminated by applications of a fungicide. The primary method of minimizing yield losses due to stalk rots is to prioritize harvesting those fields as early as possible. This early harvest may even lead to higher grain moisture at harvest and subsequent greater grain drying costs.

KEYS TO BETTER FUNGICIDE APPLICATIONS:

Deciding when to apply a fungicide to control foliar diseases of corn in South Carolina is difficult. First, you need to utilize the other control measures available. Crop rotation, especially avoiding monocropping of corn, is critical to minimizing the fungal inoculum present on crop debris for many foliar diseases such as Northern Corn Leaf Blight. The use of minimum tillage in fields that will be monocropped or that have had high levels of disease in the previous crop(s) should be avoided. Crop debris should be destroyed or buried. For most foliar diseases, resistant hybrids are available and should be used.

When is it appropriate to spray? In terms of crop growth stages, the most opportune time to spray appears to be at or near the VT/R1 growth stage. Except in very wet years, most foliar diseases develop after VT/R1. Spraying just before diseases occur allows the fungicides to function in a preventative rather than a curative mode. Most fungicides are more effective in preventing than eliminating diseases. However, spraying before disease symptoms are visible can be a gamble. If a dry weather cycle occurs most diseases will not occur. Fungicides should not be applied prior to 100% tassel or later than 14-days-after brown silk.

Tables 1, 2, and 3 list the fungicides labeled for use on corn in South Carolina. They are sorted by the number of active ingredients in each product. In general, more active ingredients provide better and longer control. However, that is a “general rule” and does not always hold true. Not all fungicides exhibit equal levels of efficacy for a specific disease and efficacy against one disease does not guarantee efficacy against a second disease. The *Corn Disease Working Group* has constructed a table giving relative efficacy ratings for many fungicides for control of each of the major foliar diseases of corn. This table is constructed with input from specialists in many states and is updated every year. It is available at <https://crop-protection-network.s3.amazonaws.com/publications/fungicide-efficacy-for-control-of-corn-diseases-filename-2020-03-18-150007.pdf>

Try to avoid spraying the same active ingredient or active ingredients within the same FRAC Code to help avoid the selection of fungal populations resistant to an active ingredient or mode of action.

Table 1. Fungicides with one active ingredient available for application to control foliar diseases of corn.

Fungicide	Active ingredient	Rate/acre	FRAC code	Days to harvest (PHI)
Aftershock 480 SC	fluoxastrobin	2 – 5.7 fl oz	11	30
Andiamo 230 ME	tetraconazole	4 - 6 fl oz	3	R3
Approach 2.08 SC	picoxystrobin	3 – 12 fl oz	11	7
Domark 230 ME	tetraconazole	4 – 6 fl oz	3	R3
Evito 480 SC	fluoxastrobin	2 – 5.7 fl. oz	11	30
Multiple generics tebuconazoles (3.6 F)	tebuconazole	4 - 6 fl oz	3	36
Headline 2.09 SC	pyraclostrobin	6 – 12 fl oz	11	7
Proline 480 SC	prothioconazole	5.7 fl oz	3	14
Propimax 3.6 EC	propiconazole	4 fl oz	3	30
Quadris 2.08 SC & Multiple generics	azoxystrobin	9.2-15.4 6 - 15.5 fl oz	11	7
AzoxyStar	azoxystrobin	6-15.5 fl oz	11	7
Tilt	propiconazole	4 fl oz	3	30
Topguard 1.04 SC	flutriafol	7 - 14 fl oz	3	7
XyWay LFR	flutriafol	7.6-15.2	3	7

Table 2. Fungicides with 2 active ingredients available for control of fungal diseases of corn.

Fungicide	Active ingredients	Rate	FRAC code	Days to Harvest
Affiance 1.5 SC	azoxystrobin + tetraconazole	10 - 17	11 + 3	7
Approach Prima 2.34 SC	picoxystrobin + cyproconazole	3.4 - 6.8	11 + 3	21
Brixen 1.85 SC	azoxystrobin + tetraconazole	13 - 19 fl oz	11 + 3	R3
Cover XL 2.2 SE	azoxystrobin + propiconazole	10.5 - 14 fl oz	11+ 3	30
Custodia	tebuconazole + azoxystrobin	9-12.9 fl oz	3 + 11	36
Delaro 325 SC	trifloxystrobin + prothioconazole	8-12 fl oz	11 + 3	14
Dexter Max 0.75 DC	mancozeb + azoxystrobin	1.6 lbs	11 + 3	40
Evito T	fluoxastrobin + tebuconazole	4-9 fl oz	11 + 3	36
Fortix 3.22 SC	fluoxastrobin + flutriafol	4 - 6 fl oz	11 + 3	30
Headline AMP 1.68 SC	pyraclostrobin + metconazole	10 - 14.4 fl oz	11 + 3	20
Helmstar Plus	azoxystrobin + tebuconazole	7.2 - 10.8	11+ 3	36
Lucento 4.17 SC	flutriafol + bixafen	3 - 5.5 fl oz	3 + 7	30
Preemptor 3.22 SC	fluoxastrobin + flutriafol	4 - 6 fl oz	11 + 3	30
Priaxor 4.17 SC	pyraclostrobin + fluxapyroxad	4 - 8 fl oz	11 + 7	21
Prosaro 421 SC	prothioconazole + tebuconazole	6.5 fl oz	3 + 3	36
Quilt	azoxystrobin + propiconazole	7-14 fl oz	11 + 3	30
Quilt Xcel 2.2 SE	azoxystrobin + propiconazole	10.5 - 14 fl oz	11 + 3	30
Stratego 2.08 SC	trifloxystrobin + propiconazole	12 fl oz	11 + 3	30
Stratego YLD 4.18 SC	trifloxystrobin + prothioconazole	4 - 5 fl oz	11 + 3	14
Zolera FX 3.34 SC	fluoxastrobin + tetraconazole	4.4 - 6.8	11 + 3	30
Topguard EQ 4.29 SC	azoxystrobin + flutriafol	5-7 fl oz	11+ 3	7

Table 3. Fungicides with 3 active ingredients available for control of fungal diseases of corn.

Fungicide	Active ingredients	Rate	FRAC code	Days to harvest
Delaro Complete	prothioconazole trifloxystrobin fluopyram	8 to 12 fl oz	3 + 11+ 7	35
Revytek 3.33 SC	fluxapyroxad + pyraclostrobin + mefentrifluconazole	8 - 15 fl oz	7 + 11 + 3	21
Trivapro 2.21 SE	benzovindiflupyr + azoxystrobin + propiconazole	13.7 fl oz	7 + 11 + 3	30

Useful References Include:

Corn Disease Working Group. 2020. Fungicide Efficacy for Control of Corn Diseases. at <https://crop-protection-network.s3.amazonaws.com/publications/fungicide-efficacy-for-control-of-corn-diseases-filename-2020-03-18-150007.pdf>

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[Wise, K., Mueller, D., Sisson, A., Smith, D., Bradley, and Robertson, A. 2016. A Farmer’s Guide to Corn Diseases. APS Press.](#)

CORN NEMATODE CONTROL

John D. Mueller, Extension Row Crop Pathologist

More than a dozen species of plant-parasitic nematodes are frequently recovered from corn fields in South Carolina. The most pathogenic species are Columbia lance nematode (*Hoplolaimus columbus*), lesion nematodes (*Pratylenchus* species), Southern root-knot nematode (*Meloidogyne incognita*), sting nematode (*Belonolaimus longicaudatus*), and stubby root nematode (*Trichodorus* species). Many other species of nematodes can feed on corn roots, but the damage threshold required to cause yield losses for these species is so high that they normally are not of concern. Ring and spiral nematodes fall into this category. The nematode species that feed on corn tend to have wide host ranges, including most of the row crops grown in South Carolina. This minimizes the opportunity to use crop rotation as a management tool. Although some nematicides are available, the application rates that growers feel they can afford often do not provide adequate control of the nematodes. To successfully manage nematodes on corn a management scheme must be developed for each individual field based on the density of each species present in the field and possible crop rotation options. To determine the nematode species and densities each field will need to be sampled and the samples sent to the Clemson University Nematode Assay Laboratory.

Nematodes primarily damage the growing points of young roots. The nematodes destroy root integrity and cause them to be swollen and dysfunctional. The damaged roots are unable to produce normal secondary roots and the result is often a “bottle brush” or “star burst” appearance. These “stubby roots” are unable to absorb the levels of water and nutrients needed by the plant for normal growth. Multiple nematode species may occur in the same field resulting in severe damage, including galling and “stubby roots”. Stubby root, Columbia lance, lesion, and sting nematodes can all cause the stubby root symptom. Nematode-infected roots are often discolored due to infections by soilborne fungi such as *Rhizoctonia* spp. and *Fusarium* spp. Above-ground symptoms resulting from nematode feeding are normally rather nondescript. Stunting can be severe, especially where nematodes occur in very sandy areas of the field. Chlorosis is not as distinct in corn as the level commonly seen from seen from nematode damage on soybean.

Yield losses are most severe in the coarse-textured sands of the Coastal plain. Most of the species can be found throughout the Coastal plains of South Carolina. Species such as Columbia lance and sting that require a soil with high sand content are not found in the Piedmont. However, other species such as lesion and stubby root are commonly found in Piedmont soils. A second species of lance nematodes, *Hoplolaimus galeatus*, is common in the Piedmont area of South Carolina. It is not found in the coarse-textured sandy soils that favor Columbia lance nematode. Like Columbia lance nematode, it has a wide host range, and no resistant corn hybrids or cotton or soybean varieties are known. Other species of nematodes including dagger nematode (*Xiphinema americanum*) and stunt nematode (*Tylenchorhynchus* species) can occur in row crop fields in South Carolina and can cause yield losses on corn. However, their damage thresholds are relatively high.

Currently, there are no commercially available hybrids known to be resistant or tolerant to any of the common nematodes occurring on corn. The nematodes which feed on corn have a very wide host range. Most include cotton and soybean in their host ranges (Table 1). The only viable rotations to reduce damage on corn from nematodes utilize peanuts. Peanuts will reduce levels of Columbia lance and Southern root-knot nematodes as well as some populations of sting nematode. However, stubby root nematode, lesion nematode, ring nematode and peanut root-knot nematode all reproduce on peanut. Soybean is very ineffective as a rotation crop to control nematodes on corn since all the nematode species which infect and reproduce on corn also reproduce on soybean.

Table 1. Host status of nematode species commonly recovered from row crop fields in South Carolina.

Nematode	Corn	Cotton	Peanut	Soybean	Grain Sorghum
Columbia lance	Host	Host	Nonhost	Host	Host
Sting	Host	Host	Nonhost/ Host	Host	Host
Stubby root	Host	Host	Host	Host	Host
Lesion	Host	Host	Host	Host	Host
Southern root-knot	Host	Host	Nonhost	Host	Host
Peanut root-knot Race 1	Host	Nonhost	Host	Host	Poor host
Peanut root-knot Race 2	Host	Nonhost	Nonhost	Host	Poor host
Ring	Host	Host	Host	Host	Host
Reniform	Nonhost	Host	Nonhost	Host	Nonhost
Soybean cyst	Nonhost	Nonhost	Nonhost	Host	Nonhost

Sampling for nematodes: Fields with histories of 3+ years of continuous corn have a high probability of having a nematode problem. Fields rotated with soybean or cotton also have a high probability of containing high nematode populations. Fields with lower-than-expected yields or yields that decline over time should be tested for nematodes.

To predict whether a specific field will be subject to nematode-induced yield losses in the following year it is recommended that you take a soil sample after the previous crop has been harvested. These samples should be taken as soon after harvest as is possible. Samples can be submitted to the Clemson University Nematode Assay Laboratory or a commercial laboratory for analysis. Nematode species present in the sample will be identified and their densities reported as “nematodes per 100 cm³ soil”. Nematodes vary widely in the densities it takes to cause yield losses (Table 2). Just 4 sting nematodes per 100 cm³ soil can cause extensive damage. For most of the species, such as root-knot or Columbia lance nematodes, the damage thresholds are between 100 and 300 nematodes per 100 cm³ soil. One of the reasons that stubby root nematode is recognized as perhaps the most common problem nematode species on corn is that the damage threshold is just 40 nematodes per 100 cm³ soil.

Using deep tillage to break hardpans can be helpful in minimizing damage from nematodes in corn. In most fields significant levels of volunteer corn sprout after harvest. These volunteer plants have large root systems which serve as a second crop to allow higher levels of survival and reproduction by nematodes in the field. Discing or chemical termination of these plants before they are 20-days old will help minimize the carryover nematode population that will serve as primary inoculum in the next crop.

Table 2. Fall threshold values for nematode species that cause damage to corn. All nematode densities are reported as nematodes per 100 cm³ soil. “High” designates the level at which severe damage (>15% yield loss) may occur and treatment with a nematicide may be cost-effective. Low indicates the level where damage can occur but may not be easily detectable.

Nematode Common name	Damage level	Sandy to Sandy Loam	Clay loam To clay
Columbia lance	High Low	100+ 6-99	200+ 150-199
Sting	High Low	4+ 4+	N.A.
Stubby root	High Low	40+ 10-39	80+ 0-79
Root-knot species	High Low	300+ 150-299	400+ 200-399
Lesion	High Low	500+ 200-499	500+ 200-499
Ring nematode	High Low	200+	600+

N.A. (not available) for sting nematodes since sting nematodes do not occur in clay or clay loam soils.

Table 2 is adapted from “Nematode Guidelines for South Carolina”, EC703 from the Clemson Extension Service by O. J. Dickerson, J. H. Blake and S. A. Lewis. This publication is available at <https://www.clemson.edu/public/regulatory/plant-problem/pdfs/nematode-guidelines-for-south-carolina.pdf>

Using Nematicides:

The wide host range of most of the nematode species that affect corn, and the absence of any resistant commercial corn hybrids means that most nematode management plans rely heavily on the use of nematicides. Several nematicides are currently available for use on corn (Table 3).

Telone II is probably the most reliable nematicide for use on corn. It will provide consistent control of all nematode species, but it has several drawbacks. It is a Restricted Use Pesticide and requires specialized application equipment. It is relatively expensive. The recommended application rate of 3.0 gallons per acre of Telone II currently costs \$50+ per acre. It must be applied 10- to 14-days prior to planting. It is effective against all the nematodes that affect corn. Counter 20G has been used for nematode control in corn for many years. It is a granular material applied over the open furrow as seed is planted. It is not as efficacious as Telone II, but the price is considerably lower. According to the Counter 20G LOCK”N LOAD label “ALS inhibitor (HRAC group 2), mesotrione (postemergence applied) and saflufenacil containing herbicides **MUST NOT** be used if Counter 20G has been applied to corn at the time of planting unless specified otherwise by the herbicide label”.

Propulse and Velum are relatively new liquid materials that are applied over the open seed furrow. Levels of control provided are not as consistent as with Telone II, but the price is considerably lower. Check with the 2EE label before applying Propulse by tank mixing it with any fertilizers or micronutrients. A 2EE label also exists for the use of Velum for suppression of nematodes at a reduced application rate on corn in South Carolina

Some seed treatments are available including both chemical nematicides such as abamectin (available in Avicta Complete Corn) and biocontrol agents such as *Bacillus firmus* I-1582 (available in Poncho Votivo 5.01 FS) or *Burkholderia* spp. A396 (available in BioST Nematicide 100).

In general results from nematicide use on corn have not been as consistent as results from nematicide usage on soybean or cotton.

Table 3. Nematicides labelled for nematode management in corn in South Carolina. Species included are Columbia lance, lesion, root-knot, and stubby root nematodes.

Nematicide	Active Ingredient(s)	Rate	Comments
Avicta Complete Corn 500/1250 with Vibrance	abamectin + thiamethoxam + azoxystrobin (FRAC 11)+ mefenoxam (FRAC 4) + fludioxonil (FRAC 12) + sedaxane (FRAC 7)	Seed Treatment 11.61 fl oz @ 1,800 seed per lb.	Available through commercial seed companies and dealer distributors.
Acceleron NemaStrike ST	tioxazafen	Seed treatment 2.5-5.0 fl oz product/80,000 seed	Use only where nematode pressure is low to moderate. To be applied by commercial seed treatment facilities only.
BioST Nematicide 100	<i>Burkholderia rinojenses</i> strain A396	Seed treatment 8 fl oz/cwt	Use only where nematode pressure is low to moderate
Luminialza	<i>Bacillus amyloliquefaciens</i> strain PTA-4838	Seed Treatment Rate not disclosed	Available through commercial seed companies and distributors.
Trunemco corn/soy	<i>Bacillus amyloliquefaciens</i> strain MBI 600 + <i>Cis-Jasmone</i>	Seed treatment 0.30 fl oz/cwt	Use where nematode pressure is low to moderate. Rate = 0.057 mg ai/seed
Counter 20G lock 'n Load	terbufos	4.5 to 6 oz. per 1,000 ft. of row for any row spacing	Apply over seed furrow at planting according to the label. Do not exceed 6.5 lbs/acre total. Read label for restrictions on herbicide comparability.
Poncho/Votivo 5.01 FS	Clothianidin + <i>Bacillus firmus</i> I-1582	Seed Treatment 2.7 fl oz/80,000 seed	Available through commercial seed companies and dealer distributors.
Propulse 3.34 SC	fluopyram + prothioconazole (FRAC codes 7 + 3)	8 fl oz In-furrow spray during planting directed on or below seed	See 2ee label Tank mixes with some fertilizers and micronutrients have been problematic.
Telone II	1,3-dichloropropene	3 – 6 gal per acre	Restricted use pesticide Can be used where nematode pressure is severe. Inject 12 inches below planting depth and seal immediately with bedding equipment. Wait 7 days before planting
Velum 4.16 SC	Fluopyram (FRAC code 7)	3 fl oz per acre	See 2(ee) label. Use as in-furrow spray during planting directed on or below seed

Useful references include:

“Nematode Guidelines for South Carolina”, EC703 from the Clemson Extension Service by O. J. Dickerson, J. H. Blake and S. A. Lewis. This publication is available at <https://www.clemson.edu/public/regulatory/plant-problem/pdfs/nematode-guidelines-for-south-carolina.pdf>

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WEED CONTROL IN COTTON

Mike Marshall, Extension Weed Specialist

Preplant Burndown Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i> Warrant 3.0ME	1.25-2.0 qt	0.94-1.5 lb	15	---	12 hours
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Comments: Apply WARRANT any time prior to planting but before weeds germinate. Provides residual control of small-seeded broadleaves and grasses. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE or PARAQUAT to control existing weeds. Do not apply ACETOCHLOR within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

<i>carfentrazone</i> Aim 2EC	1.0-2.0 fl oz	0.016-0.032 lb	14	3 days	12 hours
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Comments : Apply any time prior to planting. For best results, apply to weeds that are less than 4 inches tall (less than 3 inch rosettes). Use higher rate for treating larger weeds. Add a COC (1-2 gal per 100 gals spray solution, NIS (1 qt per 100 gals spray solution, or MSO (1-2 gal per 100 gals of spray solution). Add 2,4-D LVE to improve control of cutleaf eveningprimrose and wild radish. Tank mix partners include GLYPHOSATE, LIBERTY, GRAMOXONE, 2,4-D LVE, or CLARITY. **Rainfast interval = 6-8 hours.**

<i>dicamba</i> Clarity 4S	8.0 fl oz	0.25 lb	4	7 days	24 hours
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Comments: Excellent control of most winter annual broadleaf weeds. Following application of CLARITY and at least 1 inch rainfall, a waiting period of at least 21 days is required before cotton planting. In general, CLARITY is less effective than 2,4-D LVE on cutleaf eveningprimrose control. **Rainfast interval = 4 hours.**

<i>diuron</i> Direx 4L	1.5-2.0 pt	0.75-1.0 lb	7	7 days	12 hours
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Comments: Apply in a minimum of 10 GPA of water per acre. Controls winter annual weeds (up to 2" in size) and provides some residual control into the early growing season. Must be applied 15 to 150 days prior to cotton planting. Add a compatibility agent to the spray tank when tank mixing with GLYPHOSATE. Do not apply where soil-applied organophosphate insecticide was used as severe crop injury will occur. Do not apply to sandy or sandy loam soils with organic matter less than 1.0%. **Rainfast interval = heavy rainfall soon after application may wash product off the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

<i>fluridone</i> Brake 1.2 SC	16-32 fl oz	0.15-0.30 lb	12	None	24 hours
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Comments: Apply BRAKE up to 14 days before planting cotton. Very effective on Palmer amaranth (*glyphosate-resistant and ALS-resistant biotypes*). Do not apply more than 32 fl oz per acre per season. A residual herbicide tank mix partner with BRAKE is required if rate is below 21 fl oz/A. Tank mix partners include VALOR and DIURON Do not apply by air or through an irrigation system. Dry weather following application of BRAKE will reduce its effectiveness on Palmer amaranth. Tank mix Brake with glyphosate and 2,4-D for control of existing weeds prior to planting. Follow up BRAKE application with a residual herbicide at planting.

Preplant Burndown Herbicides for Weed Management in Cotton (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>fomesafen</i>		0.25-0.37 lb	14	70 days	24 hours
+		+			
<i>glyphosate</i>		0.99-1.50 lb ae	9		
Flexstar GT 3.5 2.82EC	3.5-5.3 pt				

Comments: Apply FLEXSTAR GT 7-14 days before planting. Very effective on Palmer amaranth (*glyphosate-resistant and ALS-resistant biotypes*) that has not emerged from the soil. Apply only to coarse textured soils (sandy loam, loamy sand, sandy clay loam). Adequate rainfall or irrigation (around 0.25") within 7 days of application is required for activation. Some crinkling or spotting of cotton foliage or stunting may occur, especially if heavy rainfall occurs during or soon after emergence, but plants outgrow these effects and develop normally. Tank mix with COTORAN, DIREX, PROWL, or STAPLE to broaden the spectrum of weed control. **Rainfast interval = heavy rainfall shortly after application may reduce product effectiveness.**

<i>flumioxazin</i>		0.063 lb	14	21 days	12 hours
Valor 51WDG	2.0 oz				
Valor EZ 4SC	2.0 fl oz				

Comments: Apply in a minimum of 10 GPA of water per acre 14-30 days prior to cotton planting. Controls cutleaf evening primrose and wild radish (*although not as effective as glyphosate + 2,4-D LVE*) and provides 2-4 weeks of residual control of weeds such as *glyphosate- and ALS-resistant Palmer amaranth*. 2,4-D or CLARITY may be tank mixed with this mixture. *Be sure to follow the clean-out instructions for removing VALOR from the sprayer following each day's use; **do not let VALOR sit overnight in the tank.*** See below for preplant burndown waiting intervals prior to cotton planting (Assumes a rate of 2.0 oz VALOR/A):

Ground Residue Amounts	Cotton Plant-Back Intervals (days before planting)	
	Strip-Till Before VALOR Application	Strip-Till following VALOR Application
<30 % residue cover	28 days	7 days
>30 % residue cover	21 days	7 days

Resistance Management: Make only **one** application of a group 14 containing herbicide per growing season.

<i>glufosinate</i>		0.53-0.79 lb	10	70 days	12 hours
Liberty 280 SL	29-43 oz				
Interline 2.34SL					

Comments: Thorough spray coverage is essential for optimum performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. Best results obtained when daytime temps exceed 75 F. Consult label for maximum season application rates for LIBERTY (burndown + in-season applications). **Rainfast interval = 4 hours.**

<i>glyphosate</i>	22-32 fl oz	0.75-1.13 lb ae	9	7 days	4 hours
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Comments: Apply in a minimum of 10 GPA of water per acre 14-30 days prior to cotton planting. Controls henbit, ryegrass, cutleaf evening primrose and wild radish (*although not as effective as glyphosate + 2,4-D LVE*). 2,4-D or CLARITY can be added to this mixture. **Rainfast interval = heavy rainfall soon after application may wash product off the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Preplant Burndown Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>oxyfluorfen</i> Goal 2XL	1.0-2.0 pt	0.25-0.5 lb	14	75 days	24 hours
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Comments: Apply GOAL 2XL a minimum of 7 days before planting cotton. Tank mix with GLYPHOSATE or PARAQUAT for control of larger winter annual broadleaf weeds or annual grasses in fallow beds (fall or late winter/early spring burndown). Provides postemergence and soil residual control of horseweed, pigweeds, and henbit.

Resistance Management: Make only one application of a group 14 containing herbicide per growing season.

<i>paraquat</i> 2S	2.0-4.0 pt	0.5-1.0 lb	22	7 days	12 hours
<i>paraquat</i> 3S	1.7-2.7 pt	0.64-1.0 lb			

Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Apply in a minimum of 10 GPA at planting. Controls seedling *glyphosate-* and *ALS-resistant Palmer amaranth* that have emerged since the early preplant burndown treatment. Add NIS at 1 qt/100 gal of spray mix. **Rainfast interval = 30 minutes.**

<i>pendimethalin</i> Prowl 3.3EC	1.8-3.6 pt	0.75-1.5 lb	3	60 days	24 hours
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Comments: Apply PROWL in a minimum of 10 GPA of water per acre up to 15 days before planting. PROWL must be activated by rainfall or irrigation soon after application. For best results, apply to weeds that are less than 4" tall (less than 3" rosettes). Use higher rate for treating larger weeds. Dense weed or cover crop stands will reduce the effectiveness of residual weed control. Add 2,4-D LVE to improve control of cutleaf eveningprimrose and Carolina geranium.

<i>pyraflufen ethyl</i> ET 0.208 EC ET X 0.338 EC	0.5-2.0 fl oz 0.3-0.6 fl oz	0.0008-0.003 lb	14	---	12 hours
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Comments: Cotton may be planted any time after ET application. For best result, apply ET to broadleaf weeds less than 4 inches tall or rosettes less than 3 inches in diameter. Do not apply more than 2.0 oz/A for burndown. Add a suitable adjuvant like NIS at 1.0% v/v (1 gal per 100 gal of spray solution) will optimize weed control. Ground application requires minimum of 10 gallons/A. Do not allow livestock to graze in treated areas. **Rainfast interval = 1 hour.**

<i>rimsulfuron</i> +		0.0157 lb	2	30 days	4 hours
<i>thifensulfuron</i> Leadoff 33.4 DF	1.5 oz	0.0157 lb	2		

Comments: Apply LEADOFF 30 days or more prior to planting cotton. LEADOFF tank mix partners include GLYPHOSATE, PARAQUAT, 2,4-D LVE, DICAMBA, or GLUFOSINATE. No additional surfactant is needed if tank mixed with glyphosate or glufosinate with a built-in adjuvant system. Otherwise, add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal or MSO at 0.5 gal per 100 gal of spray solution plus an ammonium nitrogen fertilizer (AMS at 2 lb/A or UAN at 2 qt/A).

<i>saflufenacil</i> Sharpen 2.85SC	1.0 fl oz	0.022 lb	14	80 days	12 hours
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Comments: Apply SHARPEN a minimum of **42 days** plus the accumulation of **1.0 inch of rainfall or irrigation** before planting cotton. Add COC at 1 gal per 100 gal or MSO at 1 gal per 100 gal of spray solution plus nitrogen fertilizer (UAN at 2 qt/A or AMS at 2 lb/A). If tank mixing with GLYPHOSATE, AMS is recommended. Do not apply SHARPEN with other group 14 (PPO inhibitors) products (i.e., VALOR OR REFLEX) as a tank mix or as a sequential application within 30 days or crop injury may result. Do not apply to coarse soils classified as SAND with less than 1.5% organic matter or cotton injury may result. Tank mix partners include CLARITY, DISTINCT, GLYPHOSATE, and PROWL H2O. **Rainfast interval = 1 hour.**

Preplant Burndown Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>thifensulfuron</i>		0.125-0.20 lb	2	---	12 hours
+		+			
<i>tribenuron</i>		0.125 + 0.20 lb	2		
FirstShot 50 SG	0.5-0.8 oz				

Comments: Apply 14 days before planting cotton. If applying to light-textured soils, such as sands, loamy sands, and sandy loams, wait an additional 7 days to plant. Add COC at 1 gal per 100 gals or NIS at 2 pt per 100 gal of spray solution plus nitrogen fertilizer (UAN at 2 qt/A or AMS at 2 lb/A). FIRSTSHOT may be tank mixed with 2,4-D LVE (for improved control of cutleaf eveningprimrose, henbit, and Carolina geranium), GLYPHOSATE, CLARITY, LIBERTY, or GRAMOXONE. If tank mixing with 2,4-D LVE, observe the more restrictive waiting interval to plant (14-30 days, depending on rate, see 2,4-D LVE section). **Rainfast interval = 2 hours.**

2,4-D LVE (<i>various</i>)	1.0-2.0 pt	0.5-1.0 lb	4	---	48 hours
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Comments: Apply 15-30 days prior to planting cotton. Do not use on a light, sandy soil, or where soil moisture is limiting weed growth. Very effective for cutleaf evening primrose control. Can be tank-mixed with other burndown herbicides (see label).

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Cotton¹

	Aim/ET ²	Glyphosate ²	Glyphosate + 2,4-D ²	Glyphosate + Direx ²	Glyphosate + Leadoff ²	Glyphosate + Sharpen ²	Glyphosate + Valor SX ²	Gramoxone ²	Liberty ²	Paraquat + 2,4-D ²	Paraquat + Clarity ²	Paraquat + Valor SX ²	Paraquat + Direx ²
barley, little	F	E	E	E	E	E	E	G	G	G	G	G	G
bluegrass, annual	G	F	F	E	E	E	E	G	P	G	G	G	G
buttercups	G	E	E	E	E	E	E	E	E	E	E	E	E
chickweed, common	G	F	G	GE	E	E	E	E	E	E	GE	E	E
clovers	P	PF	F	F	G	E	F	G	F	G	GE	GE	GE
cudweed	G	E	E	E	E	E	E	FG	G	FG	FG	FG	FG
dandelion	P	P	E	GE	E	G	G	N	FG	E	GE	P	GE
dock, curly	P	PF	G	F	F	F	G	F	G	FG	GE	P	F
eveningprimrose, cutleaf	GE	PF	E	GE	E	E	FG	F	G	E	GE	E	GE
geranium, Carolina	GE	FG	E	GE	E	E	E	GE	GE	E	GE	E	E
henbit/deadnettle	G	F	G	E	E	E	E	G	G	GE	E	E	GE
horseweed (marestalk)	G	E	GE	E	GE	E	GE	F	GE	GE	E	GE	GE
mustard, wild	G	FG	E	GE	G	E	GE	FG	GE	E	G	GE	G
pansy, field	G	F	F	G	---	E	F	G	G	G	G	G	GE
peanut, volunteer	F	F	F	F	P	GE	FG	P	GE	F	GE	F	F
pepperweed, Virginia	G	G	E	GE	E	E	G	G	G	GE	G	G	GE
radish, wild	G	FG	GE	GE	G	E	GE	G	GE	GE	GE	GE	GE
ryegrass, Italian	F	G	F	FG	E	E	G	FG	P	FG	FG	FG	G
sorrel, red	F	E	E	E	G	G	E	E	PF	E	E	E	E
spurry, corn	G	GE	GE	GE	E	E	G	FG	---	G	G	G	G
swinecress	G	FG	G	G	E	E	FG	PF	GE	FG	FG	PF	FG
vetch	GE	F	E	G	E	E	FG	G	GE	GE	GE	GE	G
wheat/rye cover crop	P	E	E	G	E	E	E	FG	F	F	F	G	G

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Herbicide rates for burndown are ET at 1.0 oz/A; Aim at 2.0 oz/A; Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ai/gal); 2,4-D at 1-2 pt/A; Clarity at 8 oz/A; Direx at 1.6 pt/A; Leadoff at 1.5 oz/A; Sharpen at 1.0 oz/A; Gramoxone at 3.0 pt/A; Valor SX at 2.0 oz/A; and Liberty at 29 oz/A.

Managing Herbicide Resistant Palmer Amaranth in Cotton

Palmer amaranth populations in SC are resistant to glyphosate (i.e., Roundup), acetolactate synthase (ALS) inhibiting herbicides (i.e., Staple, Envoke) and dinitroaniline (yellow) herbicides (i.e., Prowl, Treflan, and Sonalan). Nearly all (95%+) cotton varieties grown in SC are either XtendFlex (dicamba + glyphosate + glufosinate) or Enlist (2,4-D choline + glyphosate + glufosinate). The following table is designed to aid producers in managing herbicide-resistant Palmer amaranth populations in cotton. Please read the labels for each technology and follow the recommended stewardship practices to maintain their future availability in cotton. Keep in mind for weed sizes for dicamba, 2,4-D choline, and glufosinate, 4 inches or less. Also, the use of overlapping residual herbicides and rotation of postemergence herbicides will still be an important part of these varieties. With reports of dicamba and glufosinate resistant Palmer amaranth in other states, it is critical not to over-use these herbicides.

Resistant Palmer Amaranth Management in Enlist (2,4-D) or XtendFlex (Dicamba) Cotton

Herbicide Program				
Preplant Burndown (PPB), Preplant Incorporated (PPI) or Preemergence (PRE)	POST BROADCAST (1 to 4 leaf)	POST BROADCAST (5-6 leaf)	POST-DIRECTED/ LAYBY	HOODED
<i>Conventional Tillage</i> Prowl or Treflan PPI fb Reflex + diuron PRE Reflex + Staple LX <u>or</u> diuron <u>or</u> Prowl <u>or</u> Brake PRE	Palmer < 4"	Palmer < 4"	Layby Pro + MSMA OR diuron + Valor + MSMA	Paraquat
<i>Conservation Tillage Dryland</i> Valor PPB followed by diuron + Brake + paraquat PRE <u>or</u> paraquat + Reflex + diuron PRE <u>or</u> paraquat + Reflex + Warrant PRE	Liberty ¹ + Dual Magnum OR Enlist One ² + residual OR	Liberty ¹ + Warrant OR Enlist One ² + Glyphosate OR	OR diuron + Valor + MSMA OR diuron + MSMA	
<i>Conservation Tillage Irrigated</i> Valor PPB followed by diuron + Staple LX + paraquat PRE <u>or</u> paraquat + Reflex + diuron PRE <u>or</u> paraquat + Reflex + Brake PRE <u>or</u> paraquat + Warrant + Brake PRE	Dicamba ³ + residual OR Enlist Duo ²	Dicamba ³ + Glyphosate OR Enlist Duo ²	OR diuron + MSMA	

¹Liberty will not consistently control Palmer amaranth larger than 4" tall.

²USE ENLIST ONE OR ENLIST DUO HERBICIDES ONLY ON ENLIST COTTON VARIETIES. Consult the website for approved residual herbicide tank mix partners for Enlist One at www.enlisttankmix.com.

³USE ONLY XTENDIMAX, ENGENIA, or TAVIUM DICAMBA HERBICIDES ON XTENDFLEX COTTON VARIETIES. Do not use any other dicamba product on XTENDFLEX cotton. Consult the dicamba manufacturer's website for allowable tank mixes with DICAMBA.

Weed Response to Soil Applied Cotton Herbicides¹

	PPI ²		PRE ³							
	Prowl	Treflan	Brake	Command	Cotoran	Direx	Prowl	Reflex	Staple LX	Warrant
anoda, spurred	P	P	---	GE	F	F	P	---	E	---
barnyardgrass	E	E	E	E	G	G	G	P	FG	GE
beggarweed, Florida	P	P	---	FG	GE	G	P	P	G	P
bermudagrass	P	P	P	PF	P	P	P	P	P	P
citronmelon	P	P	P	P	FG	F	P	P	FG	P
cocklebur, common	P	P	P	F	GE	P	P	G	P	P
cowpea	P	P	P	P	P	P	P	P	FG	P
crabgrass	E	E	E	E	FG	FG	G	FG	P	E
crotalaria, showy	P	P	P	G	G	G	P	P	FG	P
croton, tropic	P	P	G	P	G	F	P	FG	P	---
crowfootgrass	E	E	E	E	FG	FG	G	---	---	E
dayflower, Benghal	P	P	---	P	G	P	P	P	P	---
eclipta	P	P	---	G	G	G	P	GE	G	P
goosegrass	E	E	E	E	F	F	G	---	PF	E
jimsonweed	P	P	E	G	G	G	P	---	FG	P
johnsongrass, seedling	E	E	E	G	P	P	G	---	FG	P
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P
lambsquarters, common	GE	GE	E	G	E	E	G	E	FG	F
morningglory spp.	P	P	F	P	G	F	P	PF	F	P
nutsedge, purple	P	P	P	P	P	P	P	---	P	P
nutsedge, yellow	P	P	P	P	P	P	P	GE	P	F
panicum, fall	G	G	E	E	F	P	F	---	PF	E
panicum, Texas	P	P	E	G	P	P	F	F	P	PF
pigweed spp.	G	GE	E	P	GE	GE	F	E	GE	GE
ALS-resistant	G	GE	E	P	GE	GE	F	E	P	GE
DNA-resistant	P	P	E	P	GE	GE	P	E	GE	GE
poinsettia, wild	P	P	---	G	P	P	P	GE	G	P
purslane, common	E	E	E	GE	E	F	G	G	G	G
pusley, Florida	E	E	E	GE	G	F	G	P	P	GE
ragweed, common	P	P	F	GE	E	G	P	G	P	PF
redweed	P	P	F	GE	E	GE	P	G	GE	P
ryegrass, annual	E	E	E	GE	G	G	G	P	P	G
sandbur	E	E	E	G	G	G	G	---	---	FG
senna, coffee	P	P	F	P	GE	P	P	P	G	P
sesbania, hemp	P	P	F	G	P	P	P	P	P	P
sicklepod	P	P	F	P	G	F	P	P	PF	P
sida, prickly	P	P	G	E	G	F	P	---	PF	P
signalgrass, broadleaf	G	G	E	E	P	P	G	FG	P	G
smartweed, Pennsylvania	P	P	F	G	G	G	P	---	G	PF
spurge	P	P	G	P	P	F	P	G	G	F
starbur, bristly	GE	GE	F	P	GE	G	P	GE	FG	PF
velvetleaf	P	P	G	E	F	PF	P	P	E	P
vol. peanuts	P	P	P	F	P	P	P	P	P	P

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²PPI, preplant incorporated

³PRE, preemergence

Preplant Incorporated Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>pendimethalin</i>			3	21 days	24 hours
Prowl 3.3EC	1.0-2.0 pt	0.5-1.5 lb			
Prowl H ₂ O 3.8CS	2.0-4.0 pt	0.95-1.9 lb			

Comments: Apply PROWL up to 60 days before planting and incorporate. Controls annual grasses and some small-seeded broadleaf weeds, seedling johnsongrass; poor control of large-seeded broadleaf weeds (i.e., annual morningglory, cocklebur, sicklepod). For maximum pigweed control, use 2.0 pt/A application rate. Use the lower rate if a sequential application of pendimethalin is planned at planting. Incorporate to a depth of 2 to 3 inches immediately after application. Cross disk for best results. Application within a week of planting is recommended.

NOTE: If your field(s) have a history of poor Palmer amaranth control with yellow herbicides (PROWL, TREFLAN, SONALAN), a follow-up preemergence herbicide (i.e., Dual Magnum, Warrant) will be needed at planting or early postemergence.

<i>trifluralin</i>		0.5-1.0 lb	3	60 days	12 hours
Treflan 4HFP	1.0-2.0 pt				

Comments: Controls annual grasses and some small-seeded broadleaf weeds, seedling johnsongrass; poor control of large-seeded broadleaf weeds (i.e., annual morningglory, cocklebur, sicklepod). Use 2.0 to 3.0 pt/A for rhizome johnsongrass control. For enhanced pigweed control, use 1.5 pt/A on coarse-textured soils and 2.0 pt/A on medium-textured soils. Incorporate to a depth of 2 to 3 inches immediately after application. Cross disk for best results. Application within a week of planting is recommended.

NOTE: If your field(s) have a history of poor Palmer amaranth control with yellow herbicides (PROWL, TREFLAN, SONALAN), a follow-up preemergence herbicide (i.e., DUAL MAGNUM, OUTLOOK, ZIDUA, WARRANT) will be needed at planting and/or early postemergence.

<i>trifluralin</i>		0.5-1.0 lb	3	90 days	12 hours
Treflan 4HFP	1.0-2.0 pt				
+					
<i>fluometuron</i>		1.0-2.0 lb	7		
Cotoran 4F	1.0-2.0 qt				

Comments: Controls annual grasses and broadleaf weeds, seedling johnsongrass; COTORAN improves control of large-seeded broadleaf weeds (i.e., annual morningglory, cocklebur, sicklepod). See above for soil texture and rate discussion on TREFLAN. Use lower rate of COTORAN on coarse textured soils. Incorporate to a depth of 2 to 3 inches immediately after application. Cross disk for best results. Application within a week of planting is recommended.

Preemergence Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i>		0.94-1.5 lb	15	---	12 hours
Warrant 3.0ME	1.25-2.0 qt				

Comments: Provides residual control of small seeded broadleaves and grasses. Apply after planting but before weeds germinate. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE or PARAQUAT to control weeds that have germinated since planting. Environmental conditions that follow application of WARRANT including cold, wet soils or saturated conditions from excessive rain may result in crop injury. Do not apply ACETOCHLOR within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

Preemergence Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>acetochlor</i> + <i>fomesafen</i> Warrant Ultra 3.45ME		1.07 lb + 0.24 lb 48 fl oz	15 14	45 days	12 hours
<p>Comments: Apply WARRANT ULTRA after planting soybeans but before weeds germinate. Environmental conditions that follow application of WARRANT ULTRA including cold, wet soils or saturated conditions from excessive rain may result in crop injury. Do not apply <i>acetochlor</i> within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. These restrictions do not apply to areas outside of the 50ft distance to the well.</p>					
<i>clomazone</i> Command 3ME		0.75-1.25 lb 2.0-3.33 pt	13	65 days	12 hours
<p>Comments: Controls crabgrass, fall panicum, crowfootgrass, Texas panicum, velvetleaf, spurred anoda, and prickly sida. Provides only marginal suppression of most other broadleaf weeds (i.e., <i>Palmer amaranth</i>). May be tank mix with other herbicides to broaden weed spectrum. Do not apply COMMAND to cotton unless disulfoton or phorate organophosphate insecticide is applied in-furrow with the seed at planting time at a minimum of 0.75 lb of active ingredient per acre. Do not reduce the application rate of the organophosphate insecticide when COMMAND is applied as a band treatment. Combinations of at-planting systemic granular carbamate and organophosphate insecticides applied in conjunction with COMMAND may result in injury to cotton. Crop injury may occur with higher rates of COMMAND on sandy soils. DIURON is not recommended at planting when COMMAND is used as plant injury may result. Do not apply in the air or within 1200 ft of housing developments, commercial fruit, vegetable, or nut production, or commercial ornamental nurseries or greenhouses. Do not apply more than 1.25 lb ai per acre per season. Do not allow livestock to graze on treated cotton forage or trash or feed treated cotton forage or trash to livestock.</p>					
<i>diuron</i> Direx 4L		0.8 lb 0.8 qt	7	90 days	12 hours
<p>Comments: Controls Palmer amaranth (<i>including ALS- and glyphosate-resistant</i>), common ragweed, and bristly starbur. Do not apply where soil-applied organophosphate insecticide was used as severe crop injury and stand loss will occur. Seedling diseases may weaken cotton plants and increase the possibility of injury from the use of TRIFLURALIN products followed by DIREX. These treatments should only be used in conjunction with a standard fungicide seed treatment plus a supplemental soil fungicide program such as CAPTAN-PCNB mixture. Do not apply to sands or sandy loam soils with organic matter less than 1.0%.</p>					
<i>fluometuron</i> Cotoran 4F		1.0-2.0 lb 2.0-4.0 pt	7	60 days	24 hours
<p>Comments: Controls Palmer amaranth (<i>including ALS- and glyphosate-resistant</i>), sandbur, crabgrass, tropic croton, and coffee senna. Tank mix with STAPLE LX for improved control of spurred anoda and velvetleaf. For improved pigweed control, particularly in conservation tillage, REFLEX may be applied in combination with COTORAN preemergence. Cotton injury may be observed when COTORAN is applied in combination with a systemic insecticide at planting. In addition, COTORAN applied with COMMAND may result in cotton injury. Use the lower end of the rate range on lighter soils.</p>					
<i>fluridone</i> Brake 1.2 SC		0.15-0.30 lb 16-32 fl oz	12	None	24 hours
<p>Comments: Very effective on Palmer amaranth (<i>glyphosate-resistant and ALS-resistant biotypes</i>), crabgrass, prickly sida, and crowfootgrass. A residual herbicide tank mix partner with BRAKE is required if rate is below 21 fl oz/A. Tank mix partners include REFLEX and DIURON. Do not apply more than 32 fl oz per acre per application. If there is an extended dry period following application of BRAKE, plan on scouting your fields to ensure weeds are controlled before exceeding weed size restrictions. Apply an early postemergence herbicide LIBERTY plus a residual herbicide (i.e., DUAL MAGNUM, STAPLE, or WARRANT) within 18 days after BRAKE preemergence application. Do not apply BRAKE in the same field more than 2 consecutive years.</p>					

Preemergence Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>fomesafen</i>		0.1875-0.25 lb	14	70 days	24 hours
Reflex 2 EC	12-16 fl oz				
Dawn 2 EC					

Comments: Very effective on Palmer amaranth (*glyphosate-resistant and ALS-resistant biotypes*). Apply only to coarse textured soils (sandy loam, loamy sand, sandy clay loam). Adequate rainfall or irrigation within 7 days of application is required for activation. Some crinkling or spotting of cotton foliage or stunting may occur, especially if heavy rainfall occurs during or soon after cotton emergence, but plants outgrow these effects and develop normally. Tank mix with COTORAN, DIREX, PROWL, or STAPLE to broaden the spectrum of weed control. *Tank mix MOA 14 herbicides with another MOA (postemergence and/or residual) for resistance management.*

<i>fomesafen</i>		0.25-0.37 lb	14	70 days	24 hours
+		+			
<i>glyphosate</i>		0.99-1.50 lb ae	9		
Flexstar GT 3.5 2.82EC)	3.5-5.3 pt				

Comments: Very effective on Palmer amaranth (*glyphosate-resistant and ALS-resistant biotypes*) that has not emerged from the soil. Apply only to coarse textured soils (sandy loam, loamy sand, sandy clay loam). Adequate rainfall or irrigation (around 0.25") within 7 days of application is required for activation. Some crinkling or spotting of cotton foliage or stunting may occur, especially if heavy rainfall occurs during or soon after emergence, but plants outgrow these effects and develop normally. Tank mix with COTORAN, DIREX, PROWL, or STAPLE to broaden the spectrum of weed control. *Tank mix MOA 14 herbicides with another MOA (postemergence and/or residual) for resistance management.*

<i>paraquat 2S</i>	2.0-4.0 pt	0.5-1.0 lb	22	7 days	12 hours
<i>paraquat 3S</i>	1.7-2.7 pt	0.64-1.0 lb			

Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Apply PARAQUAT broadcast or in a band behind the planter furrow in a minimum of 10 GPA at planting or after planting (but before cotton emerges) in a tank mix with residual herbicides, such as REFLEX, DIURON, WARRANT, and/or PROWL H2O. Controls seedling *glyphosate- and ALS-resistant Palmer amaranth* that have emerged since the burndown application. Increase the PARAQUAT rate and spray volume if weeds are dense or have significant size (greater than 4 inches). Add NIS at 1 qt/100 gal of spray mix. **Rainfast interval = 30 minutes.**

<i>pendimethalin</i>			3	60 days	24 hours
Prowl H ₂ O 3.8CS	1.0-2.0 pt	0.48-0.95 lb			
Prowl 3.3EC	1.2-2.4 pt	0.50-0.99 lb			

Comments: Controls Palmer amaranth (*glyphosate- and ALS-resistant biotypes*), common lambsquarters, Florida pusley, and crabgrass. Apply at planting or up to 2 days after planting.

Note: *If your field has a history of poor Palmer amaranth control with yellow herbicides, consider tank mixing PROWL with COTORAN, REFLEX, or STAPLE.*

<i>pyrithiobac</i>		0.0425-0.0525 lb	2	60 days	4 hours
Staple LX 3.2SL	1.7-2.1 fl oz				

Comments: Controls Palmer amaranth (*glyphosate-resistant biotypes*), spurred anoda, and velvetleaf. Plant stresses from cool temps, thrips damage, or excessive soil moisture may cause temporary leaf yellowing or stunting. As conditions improve, cotton will recover. Do not use on soils where organic matter is less than 0.5% or on coarse textured soils (sands or loamy sands). Do not apply more than one preemergence application of STAPLE per year. Tank mix with PROWL for improved grass control. *Tank mix MOA 2 herbicides with another MOA (postemergence and residual) for resistance management.*

Weed Response to Postemergence Broadcast Cotton Herbicides¹

	Assure II	Cotoran	Dicamba ²	Enlist Duo ³	Enlist One ³	Envoke	Envoke + Staple	Fusilade DX/Fusion	Glyphosate ⁴	Glyphosate+Dual Mag. ⁴	Glyphosate + Envoke ⁴	Glyphosate + Prowl ⁴
anoda, spurred	P	---	G	GE	G	P	G	P	GE	GE	E	GE
barnyardgrass	G	G	P	E	P	---	---	G	E	E	E	E
beggarweed, Florida	P	G	G	E	G	GE	GE	G	E	E	E	E
bermudagrass	G	P	P	F	P	P	P	G	F	F	FG	F
citronmelon	P	G	G	GE	G	GE	GE	P	GE	GE	E	GE
cocklebur, common	P	FG	E	E	E	GE	G	P	E	E	E	E
cowpea	P	FG	E	E	E	G	GE	P	E	E	E	E
crabgrass	G	PF	P	E	P	P	P	G	E	E	E	E
crotalaria, showy	P	G	G	G	E	---	---	P	G	G	G	G
croton, tropic	P	FG	GE	E	E	PF	PF	P	E	E	E	E
crowfootgrass	G	PF	P	E	P	F	P	F	E	E	E	E
dayflower, Benghal	P	P	P	FG	P	F	F	P	FG	G	G	FG
eclipta	P	---	G	E	G	P	FG	P	E	E	E	E
goosegrass	G	PF	P	E	P	P	P	G	E	E	E	E
jimsonweed	P	G	E	E	E	P	GE	P	E	E	E	E
johnsongrass, seedling	E	P	P	E	P	FG	FG	GE	E	E	E	E
johnsongrass, rhizome	E	P	P	GE	P	PF	PF	GE	GE	G	GE	E
lambsquarters, common	P	G	E	G	E	G	GE	P	G	G	E	G
morningglory spp.	P	G	E	G	E	G	G	P	G	G	E	G
nutsedge, purple	P	P	P	F	P	FG	FG	P	F	F	G	F
nutsedge, yellow	P	P	P	FG	P	G	G	P	FG	FG	GE	FG
panicum, fall	GE	PF	P	E	P	P	P	GE	E	E	E	E
panicum, Texas	G	P	P	E	P	P	P	G	E	E	E	E
pigweed spp.	P	PF	E	E	E	PF	F	P	E	E	G	E
glyphosate-resistant	P	PF	E	P	E	PF	F	P	P	P	P	P
ALS-resistant	P	PF	E	E	E	P	P	P	E	E	E	E
poinsettia, wild	P	F	E	G	E	G	G	P	G	G	E	G
purslane, common	P	FG	P	F	P	---	---	P	F	F	G	F
pusley, Florida	P	PF	P	F	P	P	P	P	F	F	PF	FG
ragweed, common	P	G	E	E	E	G	G	P	E	E	E	E
redweed	P	FG	E	GE	G	---	---	P	G	G	G	G
ryegrass, annual	G	P	P	E	P	---	---	G	E	E	E	E
sandbur, field	G	PF	P	E	P	---	P	G	E	E	E	E
senna, coffee	P	FG	E	G	FG	---	GE	P	E	E	E	E
sesbania, hemp	P	FG	E	G	FG	---	GE	P	F	F	---	---
sicklepod	P	FG	E	GE	G	E	E	P	GE	GE	E	GE
sida, prickly	P	FG	E	E	E	P	F	P	E	E	G	E
signalgrass, broadleaf	G	P	P	E	P	P	P	GE	E	E	E	E
smartweed, Pennsylvania	P	FG	E	GE	E	G	G	P	GE	GE	E	GE
spurge, annual	P	F	E	G	E	---	---	P	G	G	G	G
starbur, bristly	P	G	E	E	E	GE	GE	FG	E	E	E	E
velvetleaf	P	G	E	GE	GE	G	G	P	GE	GE	E	GE
vol. corn	G	P	P	E	P	P	P	E	E	E	E	E
RR hybrids	G	P	P	P	P	P	P	E	P	P	P	P
RR+LL hybrids	G	P	P	P	P	P	P	E	P	P	P	P
vol. peanuts	P	F	E	F	F	PF	PF	P	F	F	F	F

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²USE ONLY XTENDIMAX, TAVIUM, OR ENGENIA ERBICIDES ON DT COTTON VARIETIES.

³Use only on Enlist (2,4-D tolerant) traited cotton varieties.

⁴Use only on glyphosate tolerant cotton varieties.

Weed Response to Postemergence Broadcast Cotton Herbicides(cont)¹

	Glyphosate + Staple ²	Glyphosate + Warrant ²	Liberty ³	Liberty + Dual Mag. ³	Liberty + Prowl ³	Liberty + Warrant ³	MSMA	Poast/Poast Plus	Select/Select MAX	Sequence ²	Staple
anoda, spurred	E	GE	P	P	P	P	P	P	P	GE	G
barnyardgrass	E	E	G	G	G	G	F	GE	GE	E	---
beggarweed, Florida	E	E	G	G	G	G	E	P	P	E	G
bermudagrass	FG	F	P	P	P	P	P	F	G	F	P
citronmelon	E	GE	G	G	G	G	PF	P	P	GE	---
cocklebur, common	E	E	E	E	E	E	E	P	P	E	G
cowpea	E	E	G	G	G	G	F	P	P	E	---
crabgrass	E	E	FG	G	G	FG	F	GE	GE	E	P
crotalaria, showy	G	G	G	G	G	G	F	P	P	G	---
croton, tropic	E	E	G	G	G	G	F	P	P	E	P
crowfootgrass	E	E	G	G	G	GE	F	FG	G	E	P
dayflower, Benghal	G	FG	FG	G	FG	FG	P	P	P	FG	P
eclipta	E	E	G	G	G	G	---	P	P	E	G
goosegrass	E	E	FG	G	G	FG	F	GE	GE	E	P
jimsonweed	E	E	E	E	E	E	P	P	P	E	E
johnsongrass, seedling	E	E	G	G	G	GE	F	GE	E	E	P
johnsongrass, rhizome	GE	E	P	P	P	P	P	G	GE	E	P
lambsquarters, common	G	G	E	G	G	G	P	P	P	E	P
morningglory spp.	G	G	E	E	E	E	F	P	P	G	G
nutsedge, purple	FG	FG	P	P	P	P	F	P	P	FG	PF
nutsedge, yellow	FG	F	P	P	P	P	FG	P	P	F	PF
panicum, fall	E	E	G	G	GE	GE	F	E	E	E	P
panicum, Texas	E	E	G	G	GE	GE	P	E	E	E	P
pigweed spp.	E	E	G	G	G	G	P	P	P	E	G
glyphosate-resistant	E	P	G	G	G	G	P	P	P	P	G
ALS-resistant	E	E	G	G	G	G	P	P	P	E	P
poinsettia, wild	GE	E	GE	GE	GE	GE	N	P	P	G	F
purslane, common	G	F	FG	FG	FG	FG	P	P	P	G	F
pusley, Florida	PF	FG	P	P	G	PF	P	P	P	FG	P
ragweed, common	E	E	E	E	E	E	P	P	P	E	FG
redweed	G	G	E	E	E	E	P	P	P	G	---
ryegrass, annual	E	E	FG	FG	FG	FG	GE	G	G	E	---
sandbur, field	E	E	G	G	GE	GE	F	G	G	E	P
senna, coffee	E	E	GE	GE	GE	GE	P	P	P	E	GE
sesbania, hemp	GE	---	G	G	G	G	P	P	P	---	GE
sicklepod	GE	GE	E	E	E	E	F	P	P	E	PF
sida, prickly	G	E	G	G	G	G	P	P	P	E	F
signalgrass, broadleaf	E	E	G	G	GE	GE	F	E	E	E	P
smartweed, Pennsylvania	E	GE	GE	GE	GE	GE	P	P	P	GE	G
spurge, annual	G	G	FG	FG	FG	FG	P	P	P	G	FG
starbur, bristly	E	E	GE	GE	GE	GE	P	P	P	E	GE
velvetleaf	E	GE	G	G	G	G	P	P	P	GE	G
vol. corn	E	E	F	F	F	F	P	E	GE	E	P
RR hybrids	P	P	F	F	F	F	P	E	GE	P	P
RR+LL hybrids	P	P	P	P	P	P	P	E	GE	P	P
vol. peanuts	F	F	GE	E	GE	GE	P	P	P	F	P

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Use only on glyphosate-tolerant cotton varieties.

³Use only on glufosinate-tolerant (LibertyLink [LL]) cotton varieties.

Postemergence Broadcast Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i> Warrant 3.0ME	3 pt	1.125 lb	15	---	12 hours
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Comments: Apply WARRANT over-the-top from emergence until cotton reaches first bloom. Provides residual control of small seeded broadleaves and grasses. Optimum application timing for first broadcast application is 2-3 leaf stage followed by a second directed application at 5-6 leaf stage (see POST DIRECTED section). Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE (use only on ROUNDUP READY FLEX varieties) or LIBERTY (use only on LIBERTY LINK varieties) for control of existing weeds. Do not apply WARRANT using a sprayable fluid fertilizer as the carrier because of severe crop injury may occur. Do not apply WARRANT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

<i>clethodim</i> Select 2EC Select MAX 0.97EC	6.0-16.0 oz 9.0-32.0 oz	0.094-0.25 lb 0.068-0.24 lb	1	70 days	24 hours
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Comments: Apply SELECT/SELECT MAX anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 8 oz/A (12-14 oz/A SELECT MAX) up to 24" tall. A second 6 oz/A (6-18 oz/A SELECT MAX) treatment may be applied to control regrowth. For bermudagrass, treat 6" runners with 8 oz/A (16 oz/A SELECT MAX), and apply 8 oz/A (16 oz/A SELECT MAX) to 6" re-growth. Add COC at 1 qt/A plus AMS at 2.5-4.0 lb/A for enhanced johnsongrass and volunteer corn activity. **Rainfast interval = 1 hour.**

<i>fluzifop-p-butyl</i> Fusilade DX 2EC	8-12 fl oz	0.125-0.188 lb	1	90 days	12 hours
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Comments: Controls annual and perennial grasses before they exceed 6-8" tall. For rhizome johnsongrass control, apply 12 oz/A when it is 8-18" tall. Make a second application (8 oz/A) when regrowth is 6-12" tall. For bermudagrass, apply 12 oz/A when runners are 4-8" long, and 8 oz/A when re-growth reaches 4-8". Add COC at 1 gal/100 gallon or NIS 2 pt/100 gal of spray solution. Controls volunteer RR-corn in cotton. Do not apply after boll set. Do apply more than 48 oz/A per or within 90 days of harvest. **Rainfast interval = 1 hour.**

<i>fluzifop-p-butyl</i> +		0.13-0.19 lb +	1	90 days	24 hours
<i>fenoxaprop-p-ethyl</i> Fusion 2.56EC	8-12 oz	0.04-0.05 lb	1		

Comments: Apply FUSION at 8 oz/A for control of most annual grasses before they exceed 6-8" tall. For rhizome johnsongrass, apply 10-12 oz/A for control of johnsongrass 8-18" tall. A second 8 oz/A treatment may be applied to control regrowth 6-12" tall. For bermudagrass, treat 4-8" runners with 12 oz/A, and then apply a second application of 8 oz/A to 4-8" re-growth. Add COC at 1 gal/100 or NIS at 2 pt/100 gallon of spray solution. Controls volunteer RR-corn in cotton. **Rainfast interval = 1 hour.**

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>dicamba</i>				7 days	24 hours
Engenia 5.0SL	12.8 fl oz.	0.5 lb ae	4		
Xtendimax 2.9SL	22 fl oz.				
<i>dicamba</i> +		0.5 lb ae +	4	100 days	
<i>s-metolachlor</i>		1.0 lb	15		
Tavium 3.37CS	3.53 pt/A				

Comments: *ENGENIA*, *XTENDIMAX*, and *TAVIUM* are **RESTRICTED USE PESTICIDES (for sale and use by certified applicators ONLY)**. **USE ONLY ON DICAMBA TOLERANT COTTON VARIETIES!** No applications of these products are permitted after December 20, 2025. *ENGENIA* and *XTENDIMAX* may be applied over-the-top from emergence until July 30th. *TAVIUM* may applied over the top from emergence until the 6-leaf stage or July 30th, whichever comes first. **Do not apply after July 30th.**

Application/Equipment: For **EVERY** application of these **DICAMBA** products, an approved pH buffering adjuvant must be added to the spray mixture. Refer to www.engeniatankmix.com, www.xtendimaxtankmix.com, or www.taviumtankmix.com for a complete list of approved pH buffering adjuvants, nozzles and pressures, and approved tank mix partners. A maximum of two preemergence (0.5 lb dicamba ae/A per application) and two postemergence applications (0.5 lb dicamba ae/A per application) are allowed per year (2 lb dicamba ae/A maximum per year). **Note: TAVIUM is only registered for postemergence use in South Carolina and only one application is allowed per season on coarse-textured soils.** Apply these products in a minimum of 15 gallons per acre. Use the nozzle manufacturers recommendation for boom height or 24 inches above target pest or crop height, whichever is smaller. Do not exceed 15 miles per hour ground speed (A reduced speed is recommended at the field edges). **Do not aerially apply these products. Do not tank mix ammonium-based adjuvant products (i.e., AMS) with these herbicides.** Ensure the entire spray system is thoroughly cleaned before and after application of these products.

Environmental Conditions: Do not apply these products at wind speeds (measured at the boom height) that are less than 3 mph or greater than 10 mph. Product applications are only permitted from 1 hour after sunrise until 2 hours before sunset. Do not apply these products during temperature inversion. Do not apply if expected rainfall amount may exceed soil field capacity and result in runoff in the next 24 hours. **Rainfast interval = 4 hours (all products)**

Downwind Requirements: Do not spray these products if downwind sensitive areas, crops, or residential areas are adjacent to the spray area. After determining no sensitive areas are present downwind, maintain a 240 ft downwind spray buffer. Non-sensitive crop and areas may be used in the buffer distance calculation when directly adjacent to the treated field edges including roads, paved or gravel surfaces; mowed grassy areas adjacent to field; planted agricultural fields containing non-sensitive crops (see label for complete list); areas of bare ground from recent plowing or grading that are contiguous with the treated field; agricultural fields that have been prepared for planting; and areas covered by the footprint of a manmade structure with walls and a roof. Wind direction may change during application. **If wind direction changes toward an adjacent sensitive area, crop, or residential area, STOP SPRAYING.**

Sensitive Crops, Areas, and Residential Areas: Sensitive areas include bodies of water and nonresidential uncultivated areas that may harbor sensitive plant species. Sensitive crops are food, forage, or other plantings grown for sale, use, or consumption. Sensitive crops may also be present in nonagricultural settings, such as residential areas. Examples include non-DT soybeans; cucumbers and melons (EPA crop group 9), flowers; fruit trees; grapes; ornamentals (greenhouse and shade house grown broadleaf plants); peanuts; peas and beans (EPA crop group 6); peppers, tomatoes, and other fruiting vegetables (EPA crop group 8); potato; sweet potato; and tobacco. Consult a sensitive crop registry for potential sensitive sites near your application location.

Endangered Species: Applicators must follow the measures contained in the Endangered Species Protection Bulletin (www.epa.gov/espp/) or 1-844-447-3813 for the site or field where you are applying these products. Applicators must use the Bulletin valid for the month in which they will apply these products.

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>glufosinate</i>		0.59-0.79 lb	10	70 days	12 hours
Liberty 2.34 SL	32-43 fl oz				
Interline 2.34 SL					

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS LIBERTY-LINK! Apply LIBERTY/INTERLINE in a minimum of 15 GPA using flat fan nozzles at 30-60 PSI from emergence up to the bloom growth stage. Spray coverage is essential for maximum LIBERTY/INTERLINE performance. Controls annual grasses, broadleaf weeds, and *ALS- and glyphosate-resistant Palmer amaranth (less than 4" tall)*. Up to three over-the-top applications (do not exceed 36 oz/A per application) spaced apart by 10-14 days may be made, but do not exceed 87 oz/A per growing season. Add AMS at 3 lb/A to the spray solution. Tank mix with STAPLE or DUAL MAGNUM for residual weed control. Do not apply LIBERTY in conjunction with grass herbicides (i.e., SELECT, FUSILADE, or POAST). Applications of postemergence grass herbicides and LIBERTY/INTERLINE should be separated by at least 5 days. Do not graze the treated crop or cut for hay. **Rainfast interval = 4 hours.**

Resistance Management: Tank mix GLUFOSINATE with a residual herbicide(s) at each application. Soil residual herbicides at burndown and at planting will help ensure optimum weed management particularly if environmental conditions delay timely sprayer operations. Overlapping residual herbicides are an effective strategy to reduce weed resistance development.

<i>glyphosate</i>	32 fl oz	1.12 lb ae	9	7 days	4 hours
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Comments: USE ONLY ON GLYPHOSATE TOLERANT COTTON VARIETIES! Apply GLYPHOSATE at 1.12 lb ae/A over-the-top from ground cracking up to 7 days before harvest. Controls annual grasses and broadleaves. In general, the first over-the-top broadcast application should be applied early to minimize weed competition (1 to 3" tall weeds). No restriction on the timing of sequential treatments. Tank mix with STAPLE, DUAL MAGNUM, or WARRANT for residual control of weeds. Aerial application rates are limited to 0.75 lb ae/A. Maximum combined total of all applications from emergence through harvest cannot exceed 4.5 lb ae/A. **Rainfast interval = 2 hours.**

Resistance Management: *Glyphosate-and ALS-resistant Palmer amaranth biotypes are common in South Carolina. Apply multiple herbicide modes-of-action at each application (foliar plus residual herbicides) to prevent selection of new resistant biotypes of Palmer amaranth. Overlapping residual herbicides are an effective strategy to reduce weed resistance development.*

<i>glyphosate</i>		0.75 lb ae	9	100 days	24 hours
+		+			
<i>s-metolachlor</i>		0.94 lb	15		
Sequence 5.25L	2.5 pt				

Comments: USE ONLY ON GLYPHOSATE TOLERANT COTTON VARIETIES! Apply 2.5 pt/A over-the-top from cotyledon stage up to 10-leaf stage (not to exceed 12-inch cotton). Do not apply after the 10-leaf stage of cotton development as severe injury, including yield loss, may occur. Controls annual grasses and broadleaves. In general, the first over-the-top broadcast application should be applied early to minimize weed competition (1 to 3" tall weeds). Do not add AMS or other adjuvants. This combination provides residual control of annual grasses, pigweeds, Florida pusley, dayflower, and suppression of yellow nutsedge. Do not exceed 3.5 pt/A per season. Do not tank mix with STAPLE. **Rainfast interval = 2 hours.**

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>MSMA</i>		2.0 lb	17	--	12 hours
MSMA 6.6	2.4 pt				
MSMA 6 Plus	2.66 pt				

Comments: Apply MSMA over-the-top cotton from 3-leaf (3 inches) up to early first square stage (about 6-inch cotton), whichever comes first using ground equipment. Slight burning and a reddish coloration of the cotton leaves may occur following application, but plant will develop normally. Only one application is allowed per season (at 2 lb ai/A), except where a salvage operation is needed (i.e., Palmer amaranth escapes the first application). A second repeat salvage treatment should be timed 1 to 3 weeks after first application. Do not make more than two applications per season with a seasonal maximum of 4 lb ai per acre per season. Do not apply within 50 ft of permanent water bodies or aquatic habitat including, but not limited to lakes, reservoirs, rivers, streams, marshes, ponds, and estuaries. Apply only when conditions do not favor drift onto adjacent crops. Do not feed foliage to livestock or graze treated areas. Do not apply after first bloom.

<i>pendimethalin</i>			3	60 days	24 hours
Prowl H ₂ O 3.8CS	1.0-2.0 pt	0.48-0.95 lb			
Prowl 3.3EC	1.2-2.4 pt	0.50-0.99 lb			

Comments: Apply PROWL broadcast postemergence residual over the top after cotton reaches the 4- to 5-leaf stage of growth, but before the 8-leaf stage of growth. Over the top applications made before the 4-leaf stage or after the 8-leaf stage of development may result in crop injury and/or yield loss. Tank mix with GLYPHOSATE or LIBERTY for control of emerged weeds. If a timely irrigation follows or rain occurs after application, PROWL provides residual control of Palmer amaranth (*glyphosate- and ALS-resistant biotypes*), common lambsquarters, Florida pusley, and crabgrass. Postemergence applications of PROWL may cause temporary growth reduction and/or leaf discoloration or malformation of cotton following application. *If your field has a history of poor Palmer amaranth control with yellow herbicides, consider an alternative postemergence residual herbicide, such as WARRANT or DUAL MAGNUM.*

<i>pyrithiobac</i>		0.033-0.095 lb	2	60 days	4 hours
Staple LX 3.2SL	1.3-3.8 fl oz				

Comments: Apply STAPLE over-the-top or post-directed beginning at the first true leaf stage of cotton to control cocklebur, pigweed, and annual morningglory. *Fair to good performance on Palmer amaranth (less than 2" tall). For heavily infested field with glyphosate-resistant Palmer amaranth, apply STAPLE at 2.6 oz/A. Add NIS at 1 qt/100 gal of spray solution. May cause temporary leaf yellowing, bronzing, or crinkling particularly under cool conditions. A total of 5.1 oz/A may be applied per season. Allow a minimum of 7 days between applications. STAPLE may be tank-mixed with most insecticides approved for use on cotton. Do not tank mix with any DUAL product. DUAL and STAPLE applications should be spaced apart by at least 5 days. Do not tank-mix with malathion-containing insecticides. To avoid injury, MALATHION insecticide application should be made at least 24 hours before or after a STAPLE application. Tank mix MOA 2 herbicides with another MOA (postemergence and residual) for resistance management.*

Rainfast interval = 4 hours.

<i>quizalofop</i>		0.034-0.069 lb	1	80 days	12 hours
Assure II 0.88E	5-12 fl oz				

Comments: Apply ASSURE at 7-8 oz/A over-top to control annual grasses up to 6" tall. Apply 5 oz/A to control volunteer RR-corn in cotton. For control of rhizome johnsongrass, apply 5 oz of Assure II when johnsongrass is 10-24" tall and then retreat with 5 oz when regrowth reaches 6-10" tall. For bermudagrass control, apply 10-12 oz/A at 3" tall (up to 6" runners). Add COC at 1 gal/100 gallons or 1 qt/100 gallons of spray mixture. Application intervals should be 7 days apart to allow for regrowth. Do not exceed 18 oz/A in a growing season. **Rainfast interval = 1 hour.**

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>s-metolachlor</i> Dual Magnum 7.62EC EverpreX 7.62EC	1.0-1.33 pt	0.95-1.27 lb	15	100 days	24 hours
Comments: Apply S-METOLACHLOR at when cotton is 3 to 6 inches tall. S-METOLACHLOR does not control emerged weeds, but will provide residual control of annual grasses, pigweeds, and suppression of yellow nutsedge. Tank mix with MSMA, GLYPHOSATE (ROUNDUP READY FLEX) or LIBERTY (LIBERTY-LINK) for control of emerged weeds. Do not apply to sand or loamy sand soils.					
<i>sethoxydim</i> Poast 1.5E Poast Plus 1E	1.0-1.5 pt 1.5-2.25 pt	0.19-0.28 lb	1	75 days	12 hours
Comments: Apply POAST/POAST PLUS anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 1.5 pt/A (2.25 pt/A POAST PLUS) up to 25" tall. A second 1.0 pt/A (1.5 pt/A POAST PLUS) treatment may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A (2.25 pt/A POAST PLUS), and then apply a second application of 1.0 pt/A (1.5 pt/A POAST PLUS) to 4" re-growth. Add 1 pt/A of DASH HC or SUNDANCE HC adjuvant or COC 2 pt/A. Include UAN at 4-8 pt/A or AMS at 2.5 lb/A for enhanced crabgrass activity. Consult label for tank mix partners. Controls volunteer corn in cotton. Rainfast interval = 1 hour.					
<i>trifloxysulfuron</i> Envoke 75WDG	0.15 oz	0.0069 lb	2	60 days	12 hours
Comments: Apply ENVOKE at the 5-leaf or greater growth stage of cotton for control of pigweed, annual morningglory, and yellow nutsedge. <i>Weak on Palmer amaranth.</i> Add NIS (a minimum of 80% surface active) at 1 qt/100 gal of spray solution. Do not apply with any other additive or growth regulator as unacceptable injury may occur. Tank mix with STAPLE for enhanced smallflower morningglory control. Do not apply as a preemergence as substantial cotton injury will result. <i>Tank mix MOA 2 herbicides with another MOA (postemergence and residual) for resistance management.</i> Rainfast interval = 3 hours.					

Postemergence Broadcast Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

2,4-D choline		0.71-0.95 lb ae	4	30 days	48 hours
Enlist One 3.8SL	1.5-2.0 pt				

Comments: USE ONLY ON ENLIST COTTON VARIETIES. Apply ENLIST ONE from cotton emergence but no later than full flowering (mid-bloom stage) when weeds are small and actively growing (less than 4 inches for Palmer amaranth). **Before applying ENLIST ONE, conduct a survey of the area surrounding the planned treated field for susceptible crops (tomatoes, fruiting vegetables, cucurbits, grapes, and cotton). If a susceptible crop is clearly visible from the spray area and the wind is blowing toward it, DO NOT SPRAY.** Make one to two postemergence applications with a minimum of 12 days between applications. Water carrier volume should be 10 to 15 gallons per acre for best results. Do not apply at wind speeds are less than 3 mph or greater than 15 mph. Do not apply during temperature inversion conditions because drift potential is high. **A 30 ft downwind field buffer (where ENLIST ONE is not sprayed) is required when wind is blowing toward a sensitive area (i.e., wooded fenceline).** Spray drift potential increases significantly as boom height increases; therefore, position the boom height at the minimum height suggested on the nozzle manufacturer’s directions. **Do not aeri ally apply ENLIST ONE. Do not apply ENLIST ONE through an irrigation system.** Do not apply more than 2.0 pts per acre in a single application and more than 6.0 pts of ENLIST ONE per acre combined per season. Do not apply ENLIST ONE if rain is expected within 24 hours of application or irrigate treated fields within 24 hours. Consult ENLIST DUO label and/or the web site www.enlisttankmix.com for the most up-to-date approved tank mix partners, required spray nozzles, and stewardship practices. *To avoid future susceptible crop injury from re-use of the sprayer after spraying ENLIST ONE, thoroughly clean using clean water the tank, lines, filters, pumps, strainers, nozzles bodies, and nozzles using the triple rinse method recommended in the ENLIST ONE label.*

2,4-D choline		0.70-0.95 lb ae	4	30 days	48 hours
+		+			
glyphosate		0.73-1.01 lb ae	9		
Enlist Duo 3.3SL	3.5-4.75 pt				

Comments: USE ONLY ON ENLIST COTTON VARIETIES. Apply ENLIST DUO from emergence but no later than R2 (full flowering stage) when weeds are small and actively growing (Palmer amaranth less than 4 inches). **Before applying ENLIST DUO, consult with the sensitive crop registry to identify any commercial speciality or certified organic crops that may be planted nearby and conduct a visual survey of the area surrounding the field for the presence of susceptible crops (i.e., tomatoes, fruiting vegetables, cucurbits, grapes, and cotton). If a susceptible crop is clearly visible from the spray area and the wind is blowing toward it, DO NOT SPRAY.** Make one to two postemergence applications with a minimum of 12 days between applications. Water carrier volume should be 10 to 15 gallons per acre for best results. Do not apply at wind speeds are less than 3 mph or greater than 15 mph. Do not apply during a temperature inversion. **A 30 ft downwind buffer (where ENLIST DUO is not sprayed) is required when wind is blowing toward a sensitive area (i.e., wooded fenceline, urban area, etc.).** Spray drift potential increases significantly as boom height increases; therefore, position the boom height at the minimum height suggested on the nozzle manufacturer’s directions. **Do not aeri ally apply ENLIST DUO. Do not apply ENLIST DUO through an irrigation system.** Do not apply more than 4.75 pts per acre in a single application and more than 14.25 pts of ENLIST DUO per acre combined per season. Do not apply ENLIST DUO if rain is expected within 24 hours of application or irrigate treated fields within 24 hours. Do not apply more than two postemergence applications per year. Do not graze treated soybean. Do not harvest soybean for forage or hay. Consult ENLIST DUO label or www.enlisttankmix.com for the most current approved tank mix partners, required spray nozzles, and stewardship practices. Heavy rainfall soon after application may wash the product from the foliage and require retreatment for weed control. *Thoroughly clean sprayer tank, lines, filters, pumps, strainers, nozzles bodies, and nozzles after applying ENLIST DUO using the triple rinse method.*

Weed Response to Postemergence Directed Cotton Herbicides¹

	ET/Aim	Liberty ²	MSMA	MSMA + Caparol	MSMA + Cobra	MSMA + Cotoran	MSMA + Direx	MSMA + Layby Pro	MSMA + Suprend	MSMA + Valor	Flexstar GT ³
anoda, spurred	G	P	P	F	F	FG	F	F	F	G	E
barnyardgrass	P	FG	F	FG	F	F	F	FG	FG	FG	E
beggarweed, Florida	G	P	P	F	F	FG	F	F	F	G	E
bermudagrass	P	P	P	P	P	P	P	P	P	P	F
citronmelon	P	G	F	G	G	G	G	G	G	G	E
cocklebur, common	G	E	E	E	E	E	E	E	E	E	E
cowpea	G	G	FG	G	FG	G	G	G	G	G	E
crabgrass	P	FG	F	FG	F	F	F	FG	FG	FG	E
crotalaria, showy	G	E	G	G	G	G	G	G	G	G	E
croton, tropic	G	G	F	G	E	G	G	G	GE	E	E
crowfootgrass	P	FG	F	FG	F	F	F	FG	FG	FG	E
dayflower, Benghal	P	PF	GE	GE	GE	GE	GE	GE	GE	GE	PF
eclipta	G	G	G	G	G	G	E	E	G	E	E
goosegrass	P	F	F	FG	F	F	F	FG	FG	F	E
jimsonweed	G	E	F	G	GE	GE	G	G	G	G	E
johnsongrass, seedling	P	G	F	FG	F	F	F	FG	FG	F	E
johnsongrass, rhizome	P	F	P	P	P	P	P	P	P	P	G
lambsquarters, common	FG	E	P	G	F	G	G	G	G	G	E
morningglory spp.	GE	E	F	E	E	G	GE	GE	E	E	G
nutsedge, purple	P	P	F	F	F	F	F	F	E	FG	FG
nutsedge, yellow	P	P	FG	FG	FG	FG	G	G	E	G	G
panicum, fall	P	FG	F	FG	F	F	F	FG	FG	FG	E
panicum, Texas	P	P	P	F	P	P	P	F	F	PF	E
pigweed spp.	G	G	P	FG	G	FG	GE	GE	GE	G	E
glyphosate-resistant	G	G	P	FG	G	FG	GE	GE	GE	G	G
ALS-resistant	G	G	P	FG	G	FG	GE	GE	GE	G	E
poinsettia, wild	G	PF	PF	PF	G	F	PF	G	P	G	G
purslane, common	P	F	PF	FG	G	FG	G	G	G	G	FG
pusley, Florida	G	F	P	F	F	F	F	F	F	FG	G
ragweed, common	FG	E	F	E	E	GE	E	E	E	GE	E
redweed (chocolateweed)	G	GE	P	G	GE	FG	GE	GE	G	GE	G
ryegrass, annual	G	FG	P	P	FG	P	GE	GE	P	F	E
sandbur	P	FG	F	FG	F	F	F	FG	FG	F	E
senna, coffee	---	GE	F	G	F	G	G	G	---	G	E
sesbania, hemp	P	---	P	PF	F	PF	PF	---	---	G	GE
sicklepod	P	E	F	GE	PF	G	GE	GE	E	GE	E
sida, prickly	FG	GE	P	GE	GE	FG	GE	GE	GE	GE	G
signalgrass, broadleaf	P	FG	F	FG	F	F	F	FG	FG	F	E
smartweed, Pennsylvania	---	GE	P	F	F	G	F	F	---	G	G
spurge	G	FG	P	G	G	P	G	G	G	G	E
starbur, bristly	---	G	PF	G	G	G	G	G	GE	G	GE
velvetleaf	F	G	P	G	G	F	G	G	FG	G	E
vol. corn	P	G	P	FG	FG	FG	G	G	FG	G	E
RR hybrids	P	G	P	FG	FG	FG	G	G	FG	G	F
RR+LL hybrids	P	P	P	FG	FG	FG	G	G	FG	G	F
vol. peanut	P	E	F	F	F	F	G	G	FG	G	F

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Use only on LibertyLink (LL) cotton varieties

³Use only on glyphosate-tolerant (Gly-Tol or Roundup Ready [RR] Flex) cotton varieties.

Weed Response to Postemergence Directed Cotton Herbicides (cont)¹

	Glyphosate ²	Glyphosate + Aim/ET ²	Glyphosate + Caparol ²	Glyphosate + Direx ²	Glyphosate + Envoke ²	Glyphosate + Prowl ²	Glyphosate + Staple ²	Glyphosate + Valor ²	Prefix	Reflex	Sequence ²	HOOD	
												Paraquat	ET/Aim
anoda, spurred	E	E	E	E	E	E	E	E	P	P	E	G	G
barnyardgrass	E	E	E	E	E	E	E	E	P	P	E	G	P
beggarweed, Florida	E	E	E	E	E	E	E	E	G	G	E	E	G
bermudagrass	F	F	F	F	F	F	F	F	P	P	F	P	P
citronmelon	GE	GE	GE	GE	E	GE	E	E	G	G	E	G	P
cocklebur, common	E	E	E	E	E	E	E	E	G	G	E	G	G
cowpea	GE	GE	GE	GE	GE	GE	GE	E	F	F	GE	G	G
crabgrass	E	E	GE	GE	E	E	E	E	P	P	E	G	P
crotalaria, showy	G	G	G	G	G	G	G	G	---	---	G	G	G
croton, tropic	E	E	E	E	E	E	E	E	---	---	E	F	G
crowfootgrass	E	E	GE	GE	E	E	E	E	P	P	E	G	P
dayflower, Benghal	PF	GE	FG	FG	PF	PF	FG	GE	---	---	PF	G	P
eclipta	E	E	E	E	E	E	E	E	G	G	E	F	G
goosegrass	E	E	GE	GE	E	E	E	E	P	P	E	G	P
jimsonweed	E	E	E	E	E	E	E	E	G	G	E	G	G
johnsongrass, seedling	E	E	GE	GE	E	E	E	E	P	P	E	G	P
johnsongrass, rhizome	GE	GE	G	G	E	GE	GE	GE	P	P	GE	P	P
lambsquarters, common	G	GE	GE	GE	GE	G	GE	GE	FG	FG	G	F	FG
morningglory, annual	FG	E	GE	GE	GE	FG	GE	E	G	G	FG	FG	GE
nutsedge, purple	FG	FG	FG	FG	GE	FG	FG	GE	FG	P	FG	PF	P
nutsedge, yellow	G	F	F	F	E	G	FG	E	F	P	F	PF	P
panicum, fall	E	E	GE	GE	E	E	E	E	P	P	E	G	P
panicum, Texas	E	E	GE	GE	E	E	E	E	P	P	E	G	P
pigweed spp.	E	E	E	E	E	E	E	E	E	E	E	GE	G
glyphosate-resistant	P	F	F	G	G	P	G	G	E	E	P	GE	G
ALS-resistant	E	E	E	E	E	E	E	E	E	E	E	GE	G
poinsettia, wild	G	GE	GE	G	E	G	G	GE	G	G	GE	G	G
purslane, common	F	G	FG	GE	FG	F	FG	GE	P	P	F	G	P
pusley, Florida	PF	G	G	G	PF	PF	PF	GE	GE	GE	PF	PF	G
ragweed, common	E	E	E	E	E	E	E	E	GE	GE	GE	F	FG
redweed (chocolateweed)	GE	GE	GE	GE	GE	GE	GE	GE	G	G	GE	FG	G
ryegrass, annual	E	E	E	E	E	E	E	E	F	F	E	F	G
sandbur, field	E	E	GE	GE	E	E	E	E	P	P	E	G	P
senna, coffee	E	E	E	E	E	E	E	E	FG	FG	GE	F	---
sesbania, hemp	F	GE	GE	FG	FG	F	GE	FG	GE	GE	G	F	P
sicklepod	E	E	E	E	E	E	E	E	FG	FG	E	GE	P
sida, prickly	FG	FG	G	G	FG	FG	G	GE	FG	FG	FG	PF	FG
signalgrass, broadleaf	E	E	GE	GE	E	E	E	E	P	P	E	GE	P
smartweed, Pennsylvania	G	GE	G	G	E	G	E	G	---	---	G	G	---
spurge	G	GE	G	GE	G	G	G	G	G	G	G	G	G
starbur, bristly	GE	GE	GE	GE	GE	GE	GE	GE	---	---	GE	E	---
velvetleaf	E	E	E	E	E	E	E	E	PF	PF	E	---	F
vol. corn	E	E	E	E	E	E	E	E	FG	F	E	F	P
RR hybrids	FG	FG	FG	FG	GE	FG	FG	GE	FG	F	FG	F	P
RR+LL hybrids	FG	FG	FG	FG	GE	FG	FG	GE	FG	F	FG	F	P
vol. peanut	G	GE	G	G	FG	FG	F	FG	P	P	G	P	P

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Use only on glyphosate-tolerant (Gly-Tol or Roundup Ready [RR] Flex) cotton varieties

³Use only on Bollgard II XtendFlex cotton varieties

Postemergence Directed Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i> Warrant 3.0ME	1.5-2.0 qt	1.125 lb	15	---	12 hours
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Comments: Apply WARRANT postemergence directed from 5-6 leaf stage until cotton reaches first bloom. Provides residual control of small seeded broadleaves and grasses. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE (use only on ROUNDUP READY FLEX varieties) or LIBERTY (use only on LIBERTY LINK varieties) for control of existing weeds. Do not apply WARRANT using a sprayable fluid fertilizer as the carrier because of severe crop injury may occur. Do not apply WARRANT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

<i>carfentrazone</i> Aim 2EC	1.0-1.6 fl oz	0.013-0.025 lb	14	7 days	12 hours
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Comments: Apply AIM at 1.0-1.6 oz/A when cotton is a minimum of 6" tall (if less than 5-6 nodes, use a hooded sprayer) and where a sufficient height differential exists between crop and weed (3-4"). Care must be taken to ensure that no spray contacts green foliage or unbarked stem; otherwise, severe crop injury may occur. For best performance, apply to actively growing weeds less than 4" tall. Coverage is essential for good control. Add COC 1 gal or NIS at 2 pt/100 gallons of spray solution. For additional control of broadleaf and grass weeds, AIM may be tank mixed with other herbicides labeled for cotton post-directed and layby applications.

<i>diuron</i> Diuron 4F	1.0-1.5 pt	0.4-1.2 lb	7	---	12 hours
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Comments: Apply DIURON at 1.0-1.5 pt/A when cotton is at least 6 inches tall (1.0 pt/A on 6-8" tall cotton and 1.5 pt/A on cotton that is 8-12" tall). For enhanced control of emerged weeds, tank mix with MSMA, GLYPHOSATE, or PARAQUAT (hooded only).

<i>flumioxazin</i> Valor SX 51WDG Valor EZ 4SC	1.0-2.0 oz	0.032-0.064 lb	14	21 days	12 hours
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Comments: Apply VALOR SX at 2 oz/A when cotton is at least 18" tall as a direct spray to contact only lower 2" of bark on stem (no spray contacts green foliage or unbarked stem). Do not apply MSMA after first bloom. Add NIS at 1 qt/100 gal of spray solution. Do not use COC, MSO, organo-silicone adjuvants, or any adjuvant containing any of these. *Tank mix MOA 14 herbicides with another MOA (postemergence and residual) for resistance management. Rainfast interval = 2 hours.*

<i>flumioxazin</i> +		0.063 lb	14	60 days	12 hours
<i>pyroxasulfone</i> Fierce 76WDG Fierce EZ 2.04SC	3.0 oz 6.0 fl. oz	+ 0.080 lb	15		

Comments: Apply FIERCE at 3.0 oz/A when cotton is at least 6" tall with a directed shielded sprayer. For layby timings, FIERCE applied when cotton is at least 18" tall and should be directed at the lower 2 inches of the cotton stem to avoid injury. FIERCE should be tank mixed with MSMA, DIURON, or GLYPHOSATE to control emerged weeds. Add NIS at 1 qt per 100 gal of spray solution. Do not apply more than 3 oz/A of FIERCE during a single application. Do not apply more 6 oz/A during a single growing season. Do not make a sequential application of FIERCE within 30 days of the first application of FIERCE. **Rainfast interval = 1 hour.**

Postemergence Directed Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>fomesafen</i> +		0.25 lb	14	70 days	24 hours
<i>glyphosate</i>) Flexstar GT 3.5SL	3.5 pt	0.99 lb ae	9		

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS ROUNDUP READY FLEX! For directed applications, apply FLEXSTAR GT to cotton at least 6” tall. Apply FLEXSTAR GT to cotton at least 18” tall with 4” of bark at the base of the plant at layby. Care must be taken so that no spray contacts green foliage or unbarked stem; otherwise, severe crop injury may occur. Apply FLEXSTAR GT when weeds are small (2-4 cotyledon stage for broadleaf weeds) and if activated by rainfall will provide residual weed control. Do not apply more than 3.5 pt/A of FLEXSTAR GT per postemergence directed application per year. Tank mix partners may include any herbicide labeled for postemergence directed applications in cotton. **Rainfast interval = 1 hour.**

<i>glufosinate</i> Liberty 280 2.34SL Interline 2.34 SL		0.59-0.79 lb	10	70 days	12 hours
	32-43 fl oz				

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS LIBERTY-LINK! Apply LIBERTY at 29 oz/A as a directed application when cotton canopy prevents spray from reaching weeds below. Do not exceed 87 oz/A per season (up to three 29 oz/A applications). If weather conditions prevent a timely 1st application, then LIBERTY may be applied up to 43 oz/A to control larger weeds. If more than 29 oz/A are used in any single application, seasonal total may not exceed 72 oz/A including all application timings. Controls annual grasses and broadleaves. Direct spray allows better contact with weeds under the cotton canopy. Best results are obtained when weeds are less than 3” tall. Direct spray to the lower third of the cotton plant. Add AMS at 3 lb/A to the spray solution. For residual control of weeds, tank mix DUAL MAGNUM, WARRANT, or STAPLE. **Rainfast interval = 4 hours.**

Resistance Management: Tank mix GLUFOSINATE with a residual herbicide(s) at each application. Soil residual herbicides at burndown and at planting will help ensure optimum weed management particularly if environmental conditions delay timely sprayer operations. Overlapping residual herbicides are an effective strategy to reduce weed resistance development.

<i>glyphosate</i>	32 fl oz	1.12 lb ae	9	7 days	4 hours
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Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS ROUNDUP READY FLEX! Apply 0.63 to 1.12 lb ae/A from cracking until 7 days before harvest. Controls annual grasses and broadleaves. Direct spray allows better contact with weeds under the cotton canopy. Best results are obtained when weeds are less than 3” tall. Consult label for maximum application rates allowed during the season. Tank mixes with GLYPHOSATE labeled for post-directed applications to ROUNDUP READY FLEX cotton varieties include AIM, CAPAROL, DIREX, DUAL MAGNUM, DUAL II MAGNUM, ENVOKE, PARRLAY, STAPLE, VALOR, WARRANT, and PENDIMETHALIN. See tank mix partner labels for more information. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Resistance Management: Glyphosate-and ALS-resistant Palmer amaranth biotypes are common in South Carolina. Apply multiple herbicide modes-of-action at each application (foliar plus residual herbicides) to prevent selection of new resistant biotypes of Palmer amaranth. Overlapping residual herbicides are an effective strategy to reduce weed resistance development.

Postemergence Directed Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>glyphosate</i> +		0.75 lb ae	9	50 days	24 hours
<i>s-metolachlor</i> Sequence 5.25SL	2.5 pt	0.94 lb	15		

Comments: USE ONLY ON COTTON VARIETIES DESIGNATED AS ROUNDUP READY FLEX! Apply SEQUENCE at 2.5 pt/A up to 12" tall cotton (10 leaf stage). Do not apply later in cotton development as severe injury, including yield loss, may occur. Controls annual grasses and broadleaves. Best results are obtained when weeds are less than 3" tall. Do not exceed 3.5 pt/A of Sequence per season. Can be tank mixed with CENTRIC or KARATE insecticides. **Rainfast interval = heavy rainfall shortly after application require retreatment.**

<i>lactofen</i> Cobra 2EC	12.5 fl oz	0.195 lb	14	70 days	12 hours
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Comments: Apply COBRA when cotton is 6" tall and where sufficient height differential exists between crop and weed (3-4"). Direct spray to the lower 2 inches of the cotton stem to avoid injury. Apply when weeds are small and actively growing. Adjust nozzles to ensure full coverage of target weeds. Do not apply more than 25 fl oz/A of COBRA per year. Do not apply more than 2 applications of COBRA per season. Do not apply a sequential application of COBRA within 14 days of first application. Tank mix partners may include MSMA or DIURON. **Rainfast interval = 30 minutes.**

<i>linuron</i> +		0.25-0.5 lb	7	76 days	24 hours
<i>diuron</i> Layby Pro 4L	1.0-2.0 pt	0.25-0.5 lb	7		

Comments: Apply LAYBY PRO at 1.0-1.5 pt/A when cotton at least 8" tall and 1.6-2.0 pt/A when cotton greater than 15" tall. For control of emerged weeds (use higher rate for larger weeds; max 4" tall). Add NIS at 2 qt or COC at 1 gal/100 gal of spray solution. **Rainfast interval = 2 hours.**

MSMA MSMA 6 Plus MSMA 6.6	2.67 pt	2.0 lb	17	---	12 hours
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Comments: Apply MSMA n a minimum of 40 gallons of water per acre when cotton is 3" tall up to first bloom. Do not apply after first bloom. A slight burning or reddish discoloration of the foliage may occur after application; however, cotton plants will develop normally. Add surfactant at 2 qt/100 gal to the spray solution. Do not apply more than 4 lb ai/A of MSMA. Do not feed treated foliage to livestock or graze treated areas. **Rainfast interval = 2 hours.**

<i>oxyflourfen</i> Goal 2XL GoalTender	1.0-2.0 pt 0.5-1.0 pt	0.25-0.5 lb	14	90 days	24 hours
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Comments: Apply GOAL/GOALTENDER when cotton is 6 to 8 inches tall. Apply when weeds are small and actively growing preferably when there are not more than 4 true leaves present. Adjust nozzles to ensure full coverage of target weeds. Do not use hollow cone nozzles. Use a minimum of 20 GPA spray volume. Do not apply more than 0.5 lb ai/A of oxyflourfen per season. GOAL/GOALTENDER may be tank mixed with other herbicides registered for postemergence use in cotton.

Postemergence Directed Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>pendimethalin</i>		0.48-0.95 lb	3	60 days	24 hours
Prowl H20 3.8CS	1.0-2.0 pt				
Prowl 3.3EC	1.2-2.4 pt				

Comments: Apply PROWL directly to the soil between rows as a directed spray following the last cultivation. Layby applications can be applied in cotton previously treated with PROWL. However, the total amount of PROWL applied per acre per season cannot exceed the highest label rate of PROWL for the given soil type. Controls Palmer amaranth (*glyphosate- and ALS-resistant biotypes*), common lambsquarters, Florida pusley, and crabgrass. **Note:** *If your field has a history of poor Palmer amaranth control with yellow herbicides, consider alternative soil residual partner for GLYPHOSATE (i.e., DUAL or WARRANT).* **Rainfast interval = N/A.**

<i>prometryn</i>		1.2 lb	5	---	12 hours
Caparol 4L	2.4 pt				

Comments: Apply CAPAROL up to 2.4 pt/A when cotton is at least 12" tall and before weeds are 2 inches in height. Add NIS at 2 qt/100 gal of spray solution. Tank mix partners may include GLYPHOSATE, MSMA, or PARAQUAT (hooded applications only).

<i>prometryn</i>		0.79-1.18 lb	7	60 days	12 hours
+		+			
<i>trifloxysulfuron</i>		0.007-0.0105 lb	2		
Suprend 80WDG)	1.0-1.5 lb				

Comments: Apply SUPREND at 1.0-1.5 lb/A when cotton is at least 6" tall. For control of emerged weeds (use higher rate for larger weeds; less than 6" tall). Add surfactant at 2 qt/100 gal to the spray solution. Do not tank mix SUPREND with MALATHION, PROFENFOS, DENIM, ACEPHATE, BIDRIN, CAPTURE, KARATE or unacceptable crop injury may occur. Do not exceed 0.0188 lb ai/A of trifloxysulfuron per year. **Rainfast interval = 3 hours.**

<i>pyraflufen ethyl</i>		0.0008-0.0016 lb	14	7 days	12 hours
ET 0.208EC	0.5-1.0 fl oz				
ET X 0.338EC	0.3-0.6 fl oz				

Comments: Apply ET at 0.5-1.0 fl oz/A or ET X at 0.3-0.6 fl oz/A when cotton is at least 18" tall and has a minimum of 3" of stem bark. Apply when weeds are less than 4" tall. Avoid contact with desirable foliage. Allow a minimum of 30 days between applications. **Rainfast interval = 1 hour.**

<i>s-metolachlor</i>		0.95-1.27 lb	15	80 days	24 hours
Dual Magnum 7.62 EC	1.0-1.33 qt				

Comments: Apply DUALMAGNUM at 1.0-1.33 pt/A when cotton is at least 3 inches tall. For enhanced control of emerged weeds, tank mix with MSMA, GLYPHOSATE, CAPAROL or COTORAN.

<i>s-metolachlor</i>		1.09-1.26 lb	15	80 days	24 hours
+		+			
<i>fomesafen</i>		0.24-0.28 lb	14		
Prefix 5.29EC	2.0-2.33 pt				

Comments: For directed applications, apply PREFIX to cotton at least 6" tall. Apply PREFIX to cotton at least 18" tall with 4" of bark at the base of the plant at layby. Care must be taken so that no spray contacts green foliage or unbarked stem; otherwise, severe crop injury may occur. PREFIX will control small emerged weeds (2-4 cotyledons for broadleaf weeds) and if activated by rainfall within 7-10 days will provide residual weed control. Add NIS at 1-2 qt or COC at 1 gal/100 gallons of spray solution. Do not apply more than 2.33 pt/A of PREFIX per season. Do not add liquid nitrogen to PREFIX tank mixes in cotton. Tank mix partners may include CAPAROL, DSMA, DIREX, ENVOKE, KARMEK, LAYBY PRO, MSMA, GLYPHOSATE (glyphosate-tolerant cotton varieties only), and SUPREND. **Rainfast interval = N/A.**

Postemergence Directed Herbicides for Weed Management in Cotton (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>trifloxysulfuron</i> Envoke 75WDG	0.15 oz	0.0069 lb	2	60 days	12 hours

Comments: Apply ENVOKE at 0.15 oz/A when cotton at least 6" tall through layby. For control of emerged weeds (use higher rate for larger weeds; max 4" tall). Add NIS at 2 qt or COC at 1 gal/100 gal of spray solution. *Tank mix MOA 2 herbicides with another MOA (postemergence and residual) for resistance management.* **Rainfast interval = 3 hours.**

Hooded Sprayer Herbicides for Weed Management in Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>carfentrazone</i> Aim 2EC	1.0-1.6 fl oz	0.013-0.025 lb	14	7 days	12 hours

Comments: Apply AIM at 1.0-1.6 oz/A when cotton is a minimum of 6" tall and a sufficient height differential exists between crop and weed (3-4"). Care must be taken to ensure that no spray contacts green foliage or unbarked stem; otherwise, severe crop injury may occur. For best performance, apply to actively growing weeds less than 4" tall. Coverage is essential for good control. Add COC 1 gal or NIS at 2 pt/100 gallons of spray solution. For additional control of broadleaf and grass weeds, AIM may be tank mixed with other cotton herbicides labeled for post-directed, layby, and hooded applications.

<i>MSMA</i> MSMA 6 Plus MSMA 6.6	2.67 pt	2.0 lb	17	---	12 hours
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Comments: Apply MSMA in a minimum of 40 gallons of water per acre when when a sufficient height differential exists between the crop and weeds (3-4"). Do not apply after first bloom. Add surfactant at 2 qt/100 gal to the spray solution. Do not apply more than 4 lb ai/A of MSMA. Do not feed treated foliage to livestock or graze treated areas. **Rainfast interval = 2 hours.**

<i>paraquat 2S</i>	1.2-2.0 pt	0.3-0.5 lb	22	15 days	24 hours
<i>paraquat 3S</i>	0.8-1.3 pt	0.3-0.49 lb			

Comments: Hoods should be kept as close to the ground as possible. Do not allow the spray to contact stems or foliage of cotton. Apply in a minimum of 10 GPA at a maximum of 25 PSI. Do not exceed 5 MPH. Cotton should be at least 8" tall. Add NIS at 2 pt or COC at 1 gal/100 gal of spray solution. Allow 14 days between multiple applications. CAPAROL or DIREX may be tank mixed with PARAQUAT and will enhance residual weed control. **Rainfast interval = 30 minutes.**

<i>pyraflufen ethyl</i> ET 0.208EC ET X 0.335EC	0.5-1.0 fl oz 0.3-1.25 fl oz	0.0008-0.0033 lb	14	7 days	12 hours
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Comments: Apply ET at 0.5-1.0 fl oz/A or ETX at 0.3-1.25 fl oz/A when cotton is 18 inches or more and has a least 3 inches of stem bark using hooded ground equipment only. Apply when weeds are less than 4" tall. Avoid contact with desirable foliage. Allow a minimum of 30 days between applications. Do not exceed 0.0033 lb ai ET/ETX per season.

Harvest Aids for Cotton

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i>		0.025 lb	14	7 days	12 hours
Aim 2 EC	1.6 fl oz				

Comments: Apply AIM up to 1.6 oz/A after 60 to 70% of the bolls are open. Use a minimum of 10 gallons per acre for ground applications and 5 gallons per acre for aerial applications. Coverage is essential for good defoliation. A repeat application of up to 1.6 oz/A is allowed if foliage is remaining or regrowth is occurring. Dense canopy, large plant sizes, and environmental conditions non-conducive to complete plant coverage may reduce initial application performance and increase need for a second application. AIM may be tank mixed with PREP, FINISH, DEF, DROPP, FOLEX, HARVADE, GINSTAR, COTTONQUIK, or other registered cotton harvest aid products. Do not apply more than 3.2 oz/A per season as a harvest aid. Add a NIS a 0.25% v/v (warmer periods of defoliation) or COC at 1 gal per 100 gal (cooler periods of defoliation). **Rainfast interval = 6-8 hours.**

<i>pyraflufen ethyl</i>		0.0008-0.0033 lb	14	7 days	12 hours
ET 0.208EC	1.5-2.75 fl oz				
ET X 0.335EC	0.9-1.7 fl oz				

Comments: Apply ET at 1.5-2.75 fl oz/A or ETX at 0.9-1.7 fl oz/A after bolls are 60% open. Use 20 to 30 gallons per acre for ground applications or 5 gallons per acre for aerial applications. Coverage is essential for good defoliation. Adequate defoliation is generally achieved within 7 to 14 days after application. Do not make more than two applications or exceed 5.5 fl oz/A of ET or 3.4 fl oz/A of ET X. Sequential applications must be made a minimum of 7 days apart. ET/ET X may be tank mixed with COTTONQUIK, CYCLONE, DROPP, FINISH, FOLEX, GINSTAR, PREP, PARAQUAT, and/or GLYPHOSATE. **Rainfast interval = 1 hour.**

<i>Glyphosate</i>			9	7 days	12 hours
acid equivalent (ae)					
4.5 lb ae/gal	22-44 fl oz	0.75-1.5 lb ae			

Comments: Apply GLYPHOSATE after 60% of the bolls are open (non-Roundup Ready cotton). Can be tank mixed with some defoliant; see labels for details. Apply to Roundup Ready cotton varieties after 20% cracked boll stage or to Roundup Ready FLEX cotton up to 7 days before harvest. Do not apply GLYPHOSATE to cotton grown for seed as a reduction in vigor or germination may occur. **Rainfast interval = heavy rainfall soon after application may wash product off the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

<i>Paraquat 2S</i>	8.0 fl oz			7 days	12 hours
		0.13 lb	22		
<i>Paraquat 3S</i>	5.4 fl oz				

Comments: Defoliate cotton as normal. After at least 75-80% of bolls are open, the remaining bolls expected to be harvested are mature, and most of the cotton leaves have dropped, apply GRAMOXONE in a minimum of 20 GPA and add 1 pt NIS per 100 gal of spray solution. **Rainfast interval = 30 minutes.**

COTTON INSECT MANAGEMENT

Jeremy K. Greene, Research/Extension Entomologist

Insect pests are major limiting factors in producing cotton in South Carolina. Hundreds of species of insects can be found in cotton, but only a limited number of those species are economically important. A cotton scout must be able to identify the damaging species of insects, as well as the common beneficial arthropods. A good scouting program is still the first line of defense against insect pests in cotton. There are many valid techniques that can be used to assess the impact of insects in a field of cotton. The following information is intended to serve as a guide for use in monitoring and controlling infestations of pestiferous insects in cotton. Insecticide treatments should be applied only when numbers of insect pests reach levels that correspond to economic thresholds. Avoid treating infestations that are below thresholds because unnecessary disruptions to populations of beneficial species often result in plant injury by other arthropod pests.

Since 1996, cotton growers in South Carolina have planted cotton varieties protected from lepidopterans, such as tobacco budworm and bollworm, by genes derived from the bacterium *Bacillus thuringiensis* (Bt). Genes transferred from Bt to cotton enable plants to produce proteins toxic to caterpillars. Cells of leaves, stems, squares, blooms and bolls of these genetically engineered cotton plants contain the toxins. When caterpillars eat the proteins, their digestive enzymes activate the toxic form of the protein. The proteins bind to receptors on the lining of the insect gut, and cells are ruptured. The poisoned insects stop feeding within a few hours and die within 2 or 3 days if the dose is sufficiently high. Varieties with single-gene (first-generation) Bt technology provided excellent control (virtually 100%) of tobacco budworm and fair-to-good (about 60 to 90%) control of bollworm over the years (1996-2010). In South Carolina, there was insufficient control of bollworm with single-gene Bt cotton alone, and supplemental applications of insecticides were needed to prevent economic damage.

Thresholds for bollworm in first-generation Bt cotton were developed in response to observations that many problems with bollworm occurred in fields of Bt cotton where there had been moderate to high levels of eggs. For this reason, thresholds were adopted that called for insecticide treatments when numbers of eggs and small larvae were excessive, especially if scouts would be unable to get back within a few days to reassess infestations of larvae. An egg threshold of 75 eggs per 100 plants was instituted in the 1997 crop year, along with a threshold of 30 small worms per 100 plants. Square damage has been a poorer indicator of economic damage in Bt cotton, as most surviving larvae have been found in association with bolls and attached dried blooms (commonly called "bloom tags"). Researchers have shown that Bt toxins are apparently expressed in lower concentrations in blooms, pollen, and dried bloom tags, creating a window of opportunity for small bollworms. If small larvae can survive and grow for several days, they are not likely to be killed by Bt toxins.

Availability of Bt technologies changed on 30 September 2009 when the last opportunity to purchase first-generation Bt cotton (Bollgard varieties – for example DP555BR) for planting during the 2010 season expired (i.e. the phasing out of single-gene Bt varieties). Since 2011, almost all of the cotton acreage in South Carolina has been planted to varieties containing two or three Bt genes for production of toxic proteins. Research has shown that, when additional genes that produce supplementary toxic proteins are added, effectiveness against lepidopteran pests such as bollworm, armyworms, and soybean looper increases.

Cotton with Bt technology has many potential benefits in terms of insect control, but there will continue to be potential problems with stink bugs and other arthropod pests that are not controlled by Bt toxins and that benefit from reduced use of insecticides. Although Bt cotton has offered good-to-excellent control of important caterpillar pests, the best way to maximize benefits of planting transgenic Bt cotton is to scout vigilantly for pests, allowing properly timed sprays when necessary and detecting additional potential shifts in species importance. Researchers with Clemson University will continue to evaluate insect pest thresholds and control methods with new transgenic varieties, and adjustments will be made to recommendations as deemed appropriate.

INSECT PESTS

Thrips feed on leaves and terminals of seedling plants, thereby stunting growth and delaying maturity. Damaged leaves appear crinkled on top, and lower surfaces will often have a silvery sheen. Leaf margins become cupped and terminal buds may be destroyed. Tobacco thrips, *Frankliniella fusca*, is the predominant species encountered in cotton in South Carolina.

Aphids typically infest plant terminals and uppermost leaves initially. These soft-bodied insects have piercing-sucking mouthparts that are used to suck plant juices from leaves and stems. Heavy infestations on the undersides of leaves produce wilting and cause the leaf margins to curl toward the ground. A parasitic wasp and a fungus, *Neozygites fresenii*, often provide some control of aphids. **Whiteflies** can also damage cotton by sucking plant fluids, but this happens very rarely in South Carolina. These insects are generally controlled by naturally occurring beneficial arthropods before their damage can reduce yields. Both aphids and whiteflies excrete a substance with a high sugar content referred to as honeydew. Heavy infestations of aphids or whiteflies can produce large amounts of honeydew, thereby coating lower leaves, and giving them a shiny appearance. After mature bolls have opened, honeydew may produce sticky lint. Honeydew may also serve as a substrate for the growth of a sooty mold, which stains lint and reduces color grade.

Plant bugs (tarnished plant bug and cotton fleahopper) infrequently cause problems in June and July. Tarnished plant bugs may also puncture small bolls, inflicting damage symptoms similar to that caused by stink bugs. Adults of both species of plant bugs move to cotton from wild host plants. *Lygus* bugs develop in wild hosts such as aster, blue vervain, and fleabane, while fleahoppers are fond of tropic croton and primrose. Both adults and nymphs feed on small squares and other tender plant parts.

Tobacco budworm was a major pest of cotton before Bt cotton was commercially available in 1996. Now, 100% control is achieved with Bt cotton. Historically, most problems with tobacco budworms occurred in the Coastal Plain from moths that deposited eggs during June (pre-bloom). However, in recent years, populations of tobacco budworm have been detected in early July. Tobacco budworm and bollworm are often called the bollworm/budworm complex because they will often be present in the same field, they eat the same plant structures, and they are morphologically quite similar as larvae. Before first bloom, in non-Bt cotton, fields should be treated when 15 or more small (<0.25 inch) larvae or 20 damaged squares are found per 100 plants. After first bloom, in non-Bt cotton that has not been treated previously, insecticide should be applied at 20 or more eggs, 3 small larvae, or 5% damaged squares per 100 plants. Tobacco budworms have been documented to be resistant to multiple insecticide classes, so insecticide choices are limited in non-Bt cotton. Pyrethroid-resistant tobacco budworms occur in cotton in South Carolina and should be considered resistant to that class of chemistry.

Bollworm (corn earworm) is a key insect pest of cotton in South Carolina because it will infest most fields in the state every year. Infestations are most likely to occur in July after moths that have emerged from corn fields begin to deposit eggs on cotton plants. In the Coastal-Plain region, moth flights will usually begin within the period from 6 to 20 July, with the earliest flights occurring in the Savannah Valley area. Bollworms have generally been less of a threat in the Piedmont region, where infestations generally do not materialize before the last week in July. Insecticide applications should be triggered when numbers of eggs, larvae, or damage reach economic levels (economic thresholds). Scouting for eggs and hatching larvae is a responsibility of a cotton scout. After bollworm moths have deposited their eggs on cotton plants, the eggs will hatch in about three days. Eggs are deposited singly and generally on the upper leaf surfaces near plant terminals. By mid-July or later, moths may deposit a higher percentage of eggs lower on the plants on leaves, squares, stems, and even blooms or dried blooms (bloom tags). Scouts should check whole plants for bollworm eggs and larvae and examine the following fruiting forms on each plant: a white bloom, a pink bloom and the two smallest bolls. Remove bloom tags to look for damage on the tips of small bolls where bollworm larvae often gain entry. Historically, in first-generation Bt cotton, an insecticide treatment was recommended when 30 or more small (<0.25 inch in length) larvae were found per 100 plants, and the threshold for bollworms that were not controlled with Bt cotton (commonly called “escaped worm threshold”) was three larger (≥ 0.25 inch in length) larvae per 100 plants or 5% damaged bolls. Treatment thresholds for bollworm in second-generation Bt cotton are when egg numbers reach peak (approximately 50 eggs per 100 plants or 50% eggs) or when egg numbers exceed 20% for consecutive weeks, when 3 large (≥ 0.25 inch in length) larvae are found per 100 plants, or when 5% of squares or 5% of bolls are damaged by bollworm. After first bloom, in non-Bt cotton, insecticide should be applied at 20 or more eggs, 3 small larvae, or 5% damaged squares per 100 plants. Cotton fields should be checked at least once a week, from seedling emergence

through the first week in July. More frequent scouting is recommended from early July through mid August, primarily to detect hatch-out of bollworm larvae. Thereafter, weekly field visits should continue until most plants have reached a stage of maturity considered relatively safe from insect damage.

In 1996 pyrethroid-resistant bollworms were found in cotton fields in Hampton County near Estill, South Carolina. Vial tests conducted with moths trapped in the Savannah Valley in 1997 confirmed the presence of resistance. Also, pyrethroid resistance was confirmed from fields in Orangeburg and Calhoun Counties in August of 1997. Both of these fields were characterized by the presence of numerous large bollworms following multiple applications of pyrethroids. Pyrethroid resistance was documented in five locations below the lakes in 1998 from bollworms collected in fields where there had been control problems. Recent studies have shown that rates of survival shown by bollworm in adult vial tests and reported from confirmed field collections after exposure to pyrethroids are increasing, indicating that pyrethroid-resistance genes are still present. Efforts to monitor pyrethroid resistance will continue, but rotation of insecticide class is recommended as part of a resistance management approach. Avoiding consecutive applications of pyrethroids for bollworm would be one possible tactic to delay development of resistance. See detailed recommendations for bollworm insecticides that can be used as alternatives to pyrethroids.

Beet and fall armyworms usually do not occur until late July or early August, as neither species is known to overwinter in South Carolina. Moths of both species lay eggs in masses of 80 to 100 on the undersides of leaves. Newly emerged fall armyworms (first instars) tend to feed singly on the younger growth within the middle portion of a plant. Small beet armyworms are gregarious, and will feed in clusters on the undersides of leaves through third instars. When small larvae feed on the inner surfaces of square bracts, the etchings will be visible externally. Fall armyworms are often found in blooms, where they feed on floral tissue and pollen. Like bollworms, fall armyworms will eventually damage larger bolls. Beet armyworms feed on squares and blooms, but they usually do not bore into bolls. Large beet armyworms are capable of completely defoliating non-*Bt* cotton plants. Second- and third-generation *Bt* cotton varieties do a very good job in controlling armyworms, but they are not immune from injury, and subtle differences in efficacy exist among the technologies (see GENETIC INSECT CONTROL).

Spider mites are occasionally a problem in South Carolina cotton. Infestations of mites are often flared by extremely hot and dry weather conditions. Applications of insecticides (e.g. acephate) for other pests can also flare infestations of spider mites by reducing the numbers of beneficial arthropods that prey upon them. Initial infestations occur from spider mites moving from wild host plants or other crops into border rows of cotton. White-to-yellow speckling on the upper surfaces of leaves (in proximity to petiole attachment) will be the first indication of a mite infestation. As mites continue to feed on the undersides of leaves, the upper surfaces will become reddened. Early recognition of these symptoms and spot treating infested areas will often prevent spider mites from spreading throughout a field.

Stink bugs have piercing-sucking mouthparts that they use to pierce small bolls and suck sap from the seeds. Seed coats more or less collapse, and the attached lint often acquires a yellowish to brownish colored stain. Small, warty growths on the inside of a boll wall will generally mark the points of penetration. Warts typically form within 48 hours after penetration. Water-soaked lesions are signs of more recent penetrations, where warts may not have had time to develop. Warts may never develop when a stink bug penetrates the boll wall, fails to find a seed, and then quickly withdraws its beak. Furthermore, warts do not form on bolls that have reached full size. Damaged bolls may open prematurely or become hard-locked. Usually only one or two locks will be damaged, but occasionally, if infestations are heavy, bolls may be completely hard locked. Boll damage is the main criterion used to evaluate infestations of stink bugs. A scout should randomly select 25 or more quarter-sized bolls (about the largest soft bolls), break them open, and check the inner walls of the bolls for the damage symptoms indicated above. Care should be taken to ensure that all bolls examined are of the same age class (the largest soft bolls available) because these will provide the most reliable estimate of the actual current damage in a field. When damage symptoms are present, look for adults and large nymphs by shaking plants over a beat cloth or into a plastic pan where they can be examined and identified. It is possible that plant bugs or other sucking insects might damage small bolls, so identification is important before action is taken. By the time a boll is 25 days old, it should be relatively safe from injury.

ACTION THRESHOLDS

Compare numbers on scouting reports to recommended action thresholds described in the remarks after each table in the insecticide recommendations section to help determine need for an insecticide treatment. One must also consider

factors such as the stage of plant growth and what brand of Bt technology is being used (or if the cotton is a non-Bt variety). For some insect pests, such as bollworm, insect numbers or damaged-square counts are provided to enable a grower to determine whether or not an insecticide application is warranted. Action thresholds are not well-defined for every insect pest, and deciding whether or not to treat may be more difficult. In these situations, there is often a greater likelihood of treating a field when it is unnecessary. Threshold numbers are general in nature and are subject to professional interpretation. County agents and cotton consultants should have the expertise to help determine how these thresholds best apply to field situations on a particular farm.

RESISTANCE MANAGEMENT IN BT COTTON

Most varieties of cotton contain Bt technology (options listed in table below) for controlling caterpillar pests in the crop. A structured cotton refuge is no longer required for Bt cotton, but a “natural refuge” option is available for any brand of cottonseed containing Bt traits. Companies provide guidance about resistance management and product stewardship with Bt technology at the following web pages:

<https://www.bayer.com/en/agriculture/gmo-biotechnology>

<https://www.corteva.us/Resources/trait-stewardship.html>

<https://agriculture.basf.us/content/dam/cxm/agriculture/crop-protection/products/documents/2023-IRM.pdf>

GENETIC INSECT CONTROL

Trade name	Bollworm	Tobacco budworm	Beet armyworm	Fall armyworm	Soybean looper	Cutworm
Bollgard 2	Very Good	Excellent	Excellent	Good	Excellent	Poor
Bollgard 3	Excellent	Excellent	Excellent	Excellent	Excellent	Poor
WideStrike	Good	Excellent	Excellent	Good	Good	Poor
WideStrike 3	Very Good	Excellent	Excellent	Excellent	Excellent	Poor
TwinLink	Very Good	Excellent	Excellent	Good	Excellent	Poor
TwinLink Plus	Excellent	Excellent	Excellent	Excellent	Excellent	Poor

Transgenic Bt varieties offer cotton growers a unique technological tool for the management of lepidopterous insect pests. There are differences in their relative effectiveness against several species that are common in South Carolina.

COTTON INSECT CONTROL RECOMMENDATIONS

“Instant –View” Threshold Guide

Insect	Number per unit
Stink bugs (SB)	Stink bugs present with injury (%) to medium-sized bolls by week of bloom: 50, 30, 10, 10, 10, 20, 30, 50%; weeks 3-5 important at 10% injury
Bollworm <i>2nd & 3rd generation Bt cotton</i>	After 1 st bloom, treat at 20%+ egg lay for consecutive weeks, 3 or more larger (>0.25 inch) larvae per 100 plants or 5% square or boll damage
Bollworm <i>Non-Bt cotton</i>	After 1 st bloom: 20 or more eggs or 3 small (<0.25 inch) larvae per 100 plants or 5% damaged squares
Tobacco budworm (TBW) <i>Non-Bt cotton only – not found in Bt cotton</i>	Before 1 st bloom: 15 small (<0.25 inch) larvae per 100 plants or 20% square damage; after 1 st bloom: 20 eggs or 3 small larvae per 100 plants or 5% square damage
Tarnished plant bug (TPB)	Square retention below 75% and 8-10 per 100 sweeps or 3 per 5-6 rowft
Thrips	2 or more thrips per plant (immatures very important) and damage present
Aphids	Plants severely infested and stressed with actively growing colonies present
Fall armyworm (FAW)	10 or more per 100 plants, checking blooms and bolls
Spider mites	50% of plants infested and stressed with actively growing colonies present

This quick-view threshold table was intended to be a quick reference for treatment thresholds for the most common insect pests of cotton in South Carolina. The sections described hereafter include detailed information about thresholds and specific insecticide recommendations.

THRIPS

Product (at planting)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
aldicarb (R) AgLogic 15 GG	3.5-5.0 lb	0.525-0.75	-	48 hr	90 d	In-furrow granular
imidacloprid Gaucho 600, AERIS, TRI-O, Acceleron (check code)	- -	- -	- -	12 hr	-	Seed treatment (ST)
imidacloprid + thiamethoxam Avicta Elite, etc. (check code)	-	-	-	12 hr	-	Seed treatment
acephate Orthene/Acephate 97	Per 100 lb seed 6.4 oz	-	-	24 hr	21 d	Seed treatment
acephate Orthene/Acephate 97 Orthene/Acephate 90	16.0 oz 17.2 oz	0.97	- -	24 hr	21 d	In-furrow spray (IFS)
phorate (R) Thimet 20 G	5.0 lb	1.0	-	48 hr	60 d	In-furrow granular
imidacloprid Alias 4 F Alias 2 F Admire Pro 4.6 Velum Total 3.67	10.55 oz 21.1 oz 9.2 oz 14-18 oz	0.33	12.1 6.0 13.9 7.1-9.1	12 hr	14 d	In-furrow spray; ST + IFS not to exceed 0.5 lb/acre total

The high rate of aldicarb should also provide some protection against nematodes and suppress early populations of aphids and spider mites. When cotton is planted after May 20, seed treatments have proven to be effective in limiting thrips damage to seedling cotton plants. Avicta (with abamectin) and AERIS (with thiodicarb) have some activity on nematodes. Generally, a preventative insecticide used at planting will protect seedlings from severe stunting characteristic of thrips injury. Occasionally, however, conditions will be unfavorable for proper uptake of systemic insecticides (too cool, dry soil, excessive moisture, etc.), and plants can be severely damaged.

THRIPS

Product (foliar sprays)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
dicrotophos (R) Bidrin 8 E	3.2 oz	0.2	40	3 d	30 d	3.2 oz limit pre-bloom
acephate Orthene/Acephate 97	3.0 oz	0.18	-	24 hr	21 d	
Orthene/Acephate 90	3.2 oz		-			
dimethoate Dimethoate 4 EC	8.0 oz	0.25	16	48 hr	14 d	
spinetoram Radiant 1 SC	1.5-3.0 oz	0.0117-0.0234	42.7-85.3	4 hr	28 d	Adjuvant recommended

Foliar treatments will be most effective when applied to cotton seedlings prior to unfolding of the second true leaf. A foliar insecticide might be needed when two or more thrips are found per plant. Shake each plant (randomly select 25 or more) into a large, white cup or on a white cloth or paper to facilitate counting of adults. Use a black cup or cloth for immatures. When most plants have severely damaged growing points and immature thrips are present, one or more foliar treatments may be needed to allow the plants to resume normal growth and development. Examine plants 5-7 days after the initial treatment, and treat again if immatures are still present on most plants. When the newly unfolded leaves of infested plants are free of damage and plants appear to be growing at a normal rate, further applications of insecticides will have little benefit. Treatments applied beyond the four-leaf stage of growth may be counterproductive, as these reduce beneficial populations and often result in problems with other pests. Although effective, acephate can flare populations of spider mites and aphids.

CUTWORMS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
acephate Orthene/Acephate 97	12.0-16.0 oz	0.73-0.97	-	24 hr	21 d	
Orthene/Acephate 90	13.0-16.0 oz		-			
<i>beta</i> -cyfluthrin (R) Baythroid XL 1 EC	0.8-1.6 oz	0.0065-0.025	80-160	12 hr	0 d	
<i>lambda</i> -cyhalothrin (R) Warrior II 2.08 CS	0.96-1.28 oz	0.015-0.02	100-133	24 hr	21 d	
Silencer 1 EC or Lambda-Cy 1 EC	1.92-2.56 oz		50-67			
cypermethrin (R) Up-Cyde 2.5 EC	1.35-5.0 oz	0.026-0.097	25.6-94.8	12 hr	14 d	
<i>zeta</i> -cypermethrin/ bifenthrin (R) Hero 1.24 EC	5.2-10.3 oz	0.05-0.1	12.4-24.6	12 hr	14 d	
esfenvalerate (R) Asana XL 0.66 EC	5.8-9.6 oz	0.03-0.05	13-22	12 hr	21 d	
<i>gamma</i> -cyhalothrin (R) Declare 1.25 CS	0.77-1.02 oz	0.0075-0.01	125-166	24 hr	21 d	
<i>zeta</i> -cypermethrin (R) Mustang Max 0.8 EC	1.28-1.92 oz	0.008-0.012	67-100	12 hr	14 d	
bifenthrin (R) Discipline 2 EC or Brigade 2 EC or Fanfare 2 EC	2.6-6.4 oz	0.04-0.1	20-50	12 hr	14 d	
<i>alpha</i> -cypermethrin (R) Fastac 0.83 CS	1.3-1.9 oz	0.008-0.0123	67-98	12 hr	14 d	

Treat when cutworms threaten to reduce plant populations below an acceptable level. The risk of infestations will be greater under reduced tillage conditions and in heavier soils, where cutworms can become established on existing vegetation and will move to cotton when it emerges. Destroying established vegetation 3 to 4 weeks before planting will often prevent cutworm problems. Some of the listed insecticides may be used as “rescue” treatments on cotton

seedlings and some are labeled for pre-emergence use as either broadcast, banded, or in-furrow sprays. At-planting treatments may be warranted in situations where cutworms are already established and vegetation cannot be destroyed ahead of time. Often lower rates of insecticide can be use for these preventative at-plant treatments.

APHIDS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
sulfoxaflor Transform 50 WG	0.75-1.0 oz	0.023-0.031	-	24 hr	14 d	
pyrifluquinazon PQZ 1.87	2.4-3.2 oz	0.035-0.047	40-52	12 hr	7 d	
acetamiprid Assail 30 SG Assail or Intruder 70 WP Strafer Max 70 WG	1.5-2.5 oz 0.6-1.1 oz 0.6-1.1 oz	0.025-0.05	- - -	12 hr	28 d	Ovicidal activity on caterpillars
dicrotophos Bidrin 8	8.0 oz	0.5	16	6 d	30 d	16 oz limit post bloom
flupyradifurone Sivanto 1.67	7.0-10.5 oz	0.091-0.137	12.2-18.2	4 hr	14 d	
flonicamid Carbine 50 WG	1.4-2.8 oz	0.044-0.088	-	12 hr	30 d	
thiamethoxam Centric 40 WG	1.25-2.0 oz	0.031-0.05	-	12 hr	21 d	5 oz limit for season
imidacloprid Alias 4 F Alias 2 F Admire Pro 4.6	1.0-2.0 oz 2.0-4.0 oz 0.9-1.7 oz	0.031-0.0625	64-128 32-64 75-142	12 hr	14 d	
clothianidin Belay 2.13	3.0-5.0 oz	0.05-0.083	25.6-42.6	12 hr	Pinhead square	1 application for season
afidopyropen Sefina 0.42 DC	3.0 oz	0.0098	42.6	12hr	7 d	

Treat only when high numbers of aphids are severely infesting plants, populations are building, and the margins of terminal leaves are drooping. Aphids will cause more damage when plants are suffering from lack of moisture, and there are few signs of natural control agents. If there is evidence of widespread parasitism (dead aphids, tan colored and swollen in appearance) and/or fungal pathogens (diseased aphid bodies have a grayish-green colored fuzzy appearance) an insecticide should not be applied. Avoid unnecessary insecticide applications, as subsequent reductions in beneficial populations can result in damage from bollworm and fall armyworm.

PLANT BUGS (COTTON FLEAHOPPER AND TARNISHED PLANT BUG)

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
sulfoxaflor Transform 50 WG	1.5-2.25 oz	0.047-0.071	-	24 hr	14 d	
acephate Orthene/Acephate 97 Orthene/Acephate 90	4.1-12.3 oz 4.4-13.3 oz	0.25-0.75	- -	24 hr	21 d	
imidacloprid Alias 4 F Alias 2 F Admire Pro 4.6	1.5-2.0 oz 3.0-4.0 oz 0.9-1.7 oz	0.031- 0.0625	64-83 32-42.6 75-142	12 hr	14 d	
thiamethoxam Centric 40 WG	2.0-2.5 oz	0.05-0.0625	-	12 hr	21 d	5 oz limit for season
dicrotophos (R) Bidrin 8 E	4.0-8.0 oz	0.25-0.5	16-32	6 d	30 d	16 oz limit post bloom
oxamyl (R) Vydate 3.77 CLV	8.5-17.0 oz	0.25-0.5	7.5-15	48 hr	14 d	
clothianidin Belay 2.13	3.0-5.0 oz	0.05-0.083	25.6-42.6	12 hr	Pinhead square	1 application for season
novaluron Diamond 0.83 EC	9.0-12.0 oz	0.058-0.078	14.2-21.3	12 hr	30 d	Effective on nymphs only

Plant-bug injury to squares rarely causes economic problems in South Carolina. An economic problem could develop if an early-maturing variety was planted late, an average of 3 plant bugs per 5-6 rowft is detected using a beat cloth or beat pan, an average of 1 plant bug per 10 sweeps, or 25% or more of pinhead squares have been lost. Cotton in South Carolina is most susceptible to plant bugs around the time of first bloom. Pyrethroid insecticides generally provide suppression of plant bugs when applied at stink bug/bollworm control rates. Avoid treating Bt cotton for plant bugs unless absolutely necessary in June and July as subsequent reductions in beneficial populations often trigger problems with bollworm or fall armyworm. Plant bugs can also injure small bolls like stink bugs. For combinations of plant and stink bugs feeding on small bolls, use boll-injury treatment thresholds for stink bugs.

TOBACCO BUDWORM

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
Bt Cotton	-	-	-	-	-	
spinosad Blackhawk 36 WG	1.6-3.2 oz	0.036-0.072	-	4 hr	28 d	
indoxacarb Steward 1.25 EC	11.3 oz	0.11	11.5	12 hr	14 d	
novaluron Diamond 0.83 EC	12.0-14.0 oz	0.078-0.09	9.1-10.6	12 hr	30 d	Apply at egg hatch
methomyl (R) Lannate 2.4 LV	1.5-2.25 pt	0.45-0.675	3.5-5.3	72 hr	15 d	May redden leaves
emamectin benzoate (R) Denim 0.16 EC	8.0-12.0 oz	0.01-0.015	10.7-16	12 hr	21 d	Spider mite suppression
spinetoram Radiant 1 SC	4.25-8.0 oz	0.0332-0.0625	16-30.1	4 hr	28 d	Adjuvant recommended
chlorantraniliprole Prevathon 0.43 SC Vantacor 5 SC	14.0-27.0 oz 1.2-2.5	0.047-0.097	4.7-9.1 51.2-106	4 hr	21 d	5-d interval/application
methoxyfenozide/spinetoram Intrepid Edge 3	6.0-8.0 oz	0.14-0.1875	16-21.3	4 hr	28 d	Pre-mixed

Varieties containing Bt toxins will provide excellent control of tobacco budworm. Indoxacarb and spinosad will conserve beneficial insects and spiders. When treatments are applied using an egg threshold, some eggs will be killed prior to larval emergence. Steward has low ovicidal activity, but, when applied to eggs in the blackhead stage, larvae may be killed soon after emergence from consuming the eggshells. BEFORE FIRST BLOOM, in cotton varieties that do

not contain Bt toxins, treat when 15 small (<0.25 inch) larvae are found per 100 plant terminals, or 20% of squares are damaged. AFTER FIRST BLOOM, in non-Bt cotton, insecticide should be applied at 20 or more eggs, 3 small larvae, or 5% damaged squares per 100 plants.

ARMYWORMS (BEET AND FALL ARMYWORM)

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
Bt cotton	-	-	-	-	-	
emamectin benzoate (R) Denim 0.16 EC (BAW) Denim 0.16 EC (FAW)	6.0-8.0 oz 8.0-12.0 oz	0.0075-0.015	16-21.3 10.7-16	12 hr	21 d	Suppression of spider mites
indoxacarb Steward 1.25 EC	9.2-11.3 oz	0.09-0.11	11.5-14	12 hr	14 d	
methoxyfenozide Intrepid 2 F	4.0-10.0 oz	0.0625-0.156	12.8-32	4 hr	14 d	Higher rates for FAW
novaluron Diamond 0.83 EC	9.0-12.0 oz	0.058-0.078	10.7-14.2	12 hr	30 d	
spinosad Blackhawk 36 WG	2.4-3.2 oz	0.054-0.072	-	4 hr	28 d	
methomyl (R) Lannate 2.4 LV (FAW)	1.5-2.25 pt	0.45-0.675	3.6-5.3	3 d	15 d	May redden leaves
chlorantraniliprole Prevathon 0.43 SC Vantacor 5 SC	14.0-27.0 oz 1.2-2.5	0.047-0.097	4.7-9.1 51.2-106	4 hr	21 d	5-d interval/application
methoxyfenozide/spinetoram Intrepid Edge 3	6.0-8.0 oz	0.14-0.1875	16-21.3	4 hr	28 d	Pre-mixed

Varieties containing two or more Bt endotoxins should provide good control of armyworms. Control of fall armyworms (FAW) may be justified when 10 or more larvae are found per 100 plants. Check blooms for the presence of FAW and look for feeding symptoms on boll bracts in the lower canopy. For beet armyworms (BAW) consider applying an insecticide when there are larvae present in noticeable numbers and damage is easily observed. Populations of BAW can develop on pigweeds in the field and move to cotton and overcome the Bt toxins. Pyrethroids applied for control of stink bugs and bollworm will also provide some degree of control of eggs and newly hatched armyworms; however, after the worms have fed on cotton plants, these materials will be less effective. Best control is achieved when applications of insecticide are timed to coincide with egg hatch and emerging larvae.

BOLLWORM

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
Bt cotton	-	-	-	-	-	
Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
bifenthrin (R) Discipline 2 EC or Brigade 2 EC or Fanfare 2 EC	2.6-6.4 oz	0.04-0.1	20-50	12 hr	14 d	Control of spider mites possible at high rates
beta-cyfluthrin (R) Baythroid XL 1 EC	1.6-2.6 oz	0.0125-0.02	49-80	12 hr	0 d	
lambda-cyhalothrin (R) Warrior II 2.08 CS Silencer 1 EC or Lambda-Cy 1 EC	1.6-2.56 oz 3.2-5.12 oz	0.025-0.04	50-80 25-40	24 hr	21 d	
cypermethrin (R) Up-Cyde 2.5 EC	2.0-5.0 oz	0.04-0.1	25-64	12 hr	14 d	
zeta-cypermethrin/ bifenthrin (R) Hero 1.24 EC	5.2-10.3 oz	0.05-0.1	12.4-24.6	12 hr	14 d	
esfenvalerate (R) Asana XL 0.66 EC	9.6 oz	0.05	13	12 hr	21 d	
gamma-cyhalothrin (R) Declare 1.25 CS	1.28-2.05 oz	0.0125-0.02	63-100	24 hr	21 d	
zeta-cypermethrin (R) Mustang Max 0.8 EC	2.64-3.6 oz	0.017-0.0225	35-48	12 hr	14 d	
alpha-cypermethrin (R) Fastac 0.83 CS	3.6 oz	0.0233	35.5	12 hr	14 d	
Product (non-pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
novaluron Diamond 0.83 EC	12.0-14.0 oz	0.078-0.09	9.1-10.6	12 hr	30 d	Apply at egg hatch
indoxacarb Steward 1.25 EC	11.3 oz	0.11	11.5	12 hr	14 d	
spinosad Blackhawk 36 WG	2.4-3.2 oz	0.054-0.072	-	4 hr	28 d	
emamectin benzoate (R) Denim 0.16 EC	8.0-12.0 oz	0.01-0.015	10.7-16	12 hr	21 d	Spider mite suppression
methomyl (R) Lannate 2.4 LV	1.5-2.25 pt	0.45-0.675	3.5-5.3	72 hr	15 d	May redden leaves
spinetoram Radiant 1 SC	4.25-8.0 oz	0.0332-0.0625	16-30.1	4 hr	28 d	Adjuvant recommended
chlorantraniliprole Prevathon 0.43 SC Vantacor 5 SC	14.0-27.0 oz 1.2-2.5	0.047-0.097	4.7-9.1 51.2-106	4 hr	21 d	5-d interval/application
methoxyfenozide/spinetoram Intrepid Edge 3	6.0-8.0 oz	0.14-0.1875	16-21.3	4 hr	28 d	Pre-mixed

To reduce selection pressure for resistance in bollworm, avoid using pyrethroids before 1 July, unless infestations are extremely high. An insecticide treatment should not be needed before first bloom. Transgenic Bt cotton varieties that have two or more Bt genes have increased efficacies against bollworms; however, under potential situations of very heavy pressure from bollworm, some Bt technologies can incur significant injury and losses if not protected with supplemental/timely application(s) of insecticide. To control escaped worms in Bt cotton, an insecticide treatment should be applied when 3 or more larger (>0.25 inch) larvae are found per 100 plants or 5% of squares or 5% of bolls are damaged. Also, entire plants can be examined for eggs to determine pending pressure. Insecticide application can be justified in 2-gene Bt cotton when egg lay exceeds 20-50 eggs per 100 plants (20-50% eggs). Use at least 50% eggs for 3-gene Bt cotton. A scout should examine a white bloom, a pink bloom, and the two smallest bolls on each plant. If dried blooms (bloom tags) adhere to small bolls, remove them and look for larvae boring into the boll tips. AFTER FIRST

BLOOM, in non-Bt cotton that has not been previously treated, apply an initial insecticide treatment when 20 eggs or 3 small larvae are found per 100 plants or at 5% damaged squares. On non-Bt cotton, two treatments might be required to control bollworms following the initial moth flight in July. AFTER MID-AUGUST, consider the maturity of the crop in determining the need for a treatment. For example, 3 small larvae or 5% damaged squares may still be an applicable threshold in late-maturing non-Bt cotton (early- to mid-bloom stage of development), but this infestation level could be tolerated in cotton that is nearing cutout, where most bolls are too mature to be damaged by bollworm.

SPIDER MITES

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
bifenthrin (R) Discipline 2 EC or Brigade 2 EC or Fanfare 2 EC	3.8-6.4 oz	0.06-0.1	20-33.7	12 hr	14 d	Higher rates required for control of mites
propargite (R) Comite 6.55 Comite II 6	16.0-32.0 oz 20.0-36.0 oz	0.82-1.69	4-8 3.55-6.4	7 d	50 d	Do not apply until plants are 12 in tall
spiromesifen Oberon 2 SC Oberon 4 SC	8.0-16.0 oz 4.0-8.0 oz	0.125-0.25	8-16 16-32	12 hr	30 d	Per season 32 oz limit 16 oz limit
etoxazole Zeal 72.7 WSP	0.66-1.0 oz	0.03-0.045	-	12 hr	28 d	Max of 1 application
abamectin (R) Agri-Mek 0.15 EC or Zoro 0.15 EC	8.0-16.0 oz	0.009-0.0188	8-16	12 hr	20 d	32 oz limit per season
feproximate Portal 0.4	16.0-32.0 oz	0.05-0.1	4-8	12 hr	14 d	Limit of 2 pt per season

Infestations of spider mites usually appear in border rows of a field or sometimes in isolated spots within a field. When mites first appear, treating border rows or spot treating may prevent outbreaks.

SOYBEAN LOOPER AND CABBAGE LOOPER

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
Bt cotton	-	-	-	-	-	
spinosad Blackhawk 36 WG	2.4-3.2 oz	0.054-0.072	-	4 hr	28 d	
indoxacarb Steward 1.25 EC	6.7-9.2 oz	0.065-0.09	14-19	12 hr	14 d	
novaluron Diamond 0.83 EC	6.0-12.0 oz	0.039-0.078	10.7-21.3	12 hr	30 d	
methoxyfenozide Intrepid 2 F	4.0-10.0 oz	0.0625-0.156	12.8-32	4 hr	14 d	
emamectin benzoate (R) Denim 0.16 EC	8.0-12.0 oz	0.01-0.015	10.7-16	12 hr	21 d	Spider mite suppression
chlorantraniliprole Prevathon 0.43 SC Vantacor 5 SC	20.0-29.0 oz 1.7-2.5	0.067-0.097	4.4-6.4 51.2-75.3	4 hr	21 d	5-d interval/application
methoxyfenozide/spinetoram Intrepid Edge 3	4.0-8.0 oz	0.0938-0.1875	16-32	4 hr	28 d	Pre-mixed

Varieties containing two or more Bt toxins will provide very good control of loopers. Apply an insecticide treatment when there is 25% or more defoliation and harvestable bolls are still developing. There are two species of loopers that defoliate cotton. The cabbage looper is generally controlled by any of the listed insecticides. The soybean looper is more difficult to control and is resistant to most insecticides.

STINK BUGS

Product (non-pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
dicrotophos (R) Bidrin 8 E	4.0-8.0 oz	0.25-0.5	16-32	3 d	30 d	16 oz limit post bloom
acephate Orthene/Acephate 97 Orthene/Acephate 90	0.52-0.77 lb 0.55-0.83 lb	0.5-0.75	- -	24 hr	21 d	
oxamyl (R) Vydate 3.77 CLV	13.6-17.0 oz	0.4-0.5	7.5-9.4	48 hr	14 d	
novaluron Diamond 0.83 EC	9.0-14.0 oz	0.058-0.09	9.1-14.2	12 hr	30 d	Effective on nymphs only
Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
bifenthrin (R) Discipline 2 EC or Brigade 2 EC or Fanfare 2 EC	2.6-6.4 oz	0.04-0.1	20-50	12 hr	14 d	Some control of spider mites at high rates
beta-cyfluthrin (R) Baythroid XL 1 EC	1.6-2.6 oz	0.0125-0.02	49-80	12 hr	0 d	
lambda-cyhalothrin (R) Warrior II 2.08 CS Silencer 1 EC or Lambda-Cy 1 EC	1.6-2.56 oz 3.2-5.12 oz	0.025-0.04	50-80 25-40	24 hr	21 d	
cypermethrin (R) Up-Cyde 2.5 EC	2.0-5.0 oz	0.04-0.1	25-64	12 hr	14 d	
zeta-cypermethrin/ bifenthrin (R) Hero 1.24 EC	5.2-10.3 oz	0.05-0.1	12.4-24.6	12 hr	14 d	
esfenvalerate (R) Asana XL 0.66 EC	9.6 oz	0.05	13	12 hr	21 d	
gamma-cyhalothrin (R) Declare 1.25 CS	1.28-2.05 oz	0.0125-0.02	63-100	24 hr	21 d	
zeta-cypermethrin (R) Mustang Max 0.8 EC	2.64-3.6 oz	0.017-0.0225	35-48	12 hr	14 d	
alpha-cypermethrin (R) Fastac 0.83 CS or EC	3.6 oz	0.0233	35.5	12 hr	14 d	

Treat when medium-sized bolls display symptoms of feeding injury by week of bloom (50, 30, 10, 10, 10, 20, 30, 50%) and stink bugs are present. Begin scouting for stink bugs when small bolls appear. Consider using a more aggressive (i.e. 10%) threshold during weeks 3-5 of bloom, as bolls developing during this growth stage are particularly susceptible. Randomly select at least 25 bolls (at least a quarter [1 inch] in diameter) per field (add 1 additional boll for each acre exceeding 25 acres). Break each boll open and examine the carpal walls, lint, and seeds for injury symptoms. Look for the presence of warty growths on the carpal walls and for discolored seed and lint. To ensure the accuracy of this sampling method, do not deviate from weekly checking of quarter-size diameter bolls. One may also rate an infestation based upon numbers of stink bugs by using a 3-ft beat cloth. When this method is used, an insecticide treatment will be warranted for 1 or more stink bugs per 6 feet of row. Carefully approach and shake the plants on at least 30 feet of row (10, 3-ft samples). Pyrethroids applied for bollworm control will generally provide control of stink bugs as well. Bidrin should be used in a pyrethroid tank-mix in fields with infestations predominated by brown stink bugs. Be especially vigilant for stink bugs when no treatments are being applied for control of caterpillars.

WHITEFLIES

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
acephate Orthene/Acephate 97 Orthene/Acephate 90	8.2-16.5 oz 8.9-17.8 oz	0.5-1.0	- -	24 hr	21 d	
acetamiprid Assail 30 SG Assail or Intruder 70 WSP	4.0-5.3 oz 1.7-2.3 oz	0.075-0.1	- -	12 hr	28 d	Ovicidal activity
thiamethoxam Centric 40 WG	2.0-2.5 oz	0.05-0.0625	-	12 hr	21 d	5 oz limit for season
imidacloprid Alias 4 F Alias 2 F Admire Pro 4.6	1.0-2.0 oz 2.0-4.0 oz 0.9-1.7 oz	0.031-0.0625	64-128 32-64 75-142	12 hr	14 d	
pyriproxyfen Knack 0.86	5.0-10.0 oz	0.0538-0.067	12.8-16	12 hr	28 d	IGR – 5 oz/ac & again 14 d
afidopyropen Sefina 0.42 DC	14.0 oz	0.046	9.14	12hr	7 d	

Treat fruiting cotton when 50% of plant terminals have whiteflies present in heavy clusters on the undersides of leaves and immatures are present. Treat mature cotton when clusters of whiteflies are present in terminals, bolls are opening, and honeydew is found. Silverleaf whiteflies are more difficult to control than bandedwing whiteflies.

MULTIPLE PESTS – PRE-MIXED OR CO-PACKAGED PRODUCTS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comment
bifenthrin/acetamiprid (R) Argyle 2.52	5.0-9.0 oz	0.098-0.177	13.9-25.6	12 h	28 d	
imidacloprid/beta-cyfluthrin (R) Leverage (360) 3	2.8-3.2 oz	0.066-0.075	40-45.7	12 hr	14 d	Pre-mixed
thiamethoxam/lambda-cyhalothrin (R) Endigo 2.06 ZC Endigo 2.7 ZCX	4.5-6.0 oz 4.0-4.5 oz	0.072-0.095	21.3-28.4 28.4-32	24 hr	21 d	Pre-mixed Pre-mixed
imidacloprid/bifenthrin (R) Brigadier 2 SC	3.8-7.7 oz	0.06-0.12	16.6-33.7	12 hr	14 d	Pre-mixed
chlorantraniliprole/lambda-cyhalothrin (R) Besiege 1.25 ZC	6.5-12.5 oz	0.063-0.122	10.2-19.7	24 hr	21 d	Pre-mixed
chlorantraniliprole/bifenthrin (R) Elevest 2.22 SC	6.9-9.6 oz	0.12-0.167	13.3-18.5	12 hr	21 d	Pre-mixed
bifenthrin/avermectin (R) Athena 0.87	10.0-17.0 oz	0.068-0.115	7.5-12.8	12 hr	20 d	Pre-mixed
methoxyfenozide/spinetoram Intrepid Edge 3	4.0-8.0 oz	0.094-0.188	16-32	4 hr	28 d	Pre-mixed
alpha-cypermethrin/afidopyropen (R) Renestra 0.64 DC	6.8 oz	0.034	18.8	12 hr	14 d	Pre-mixed

For control of multiple pests exceeding thresholds, including but not limited to various combinations of the following: bollworm/corn earworm (BW/CEW), beet and fall armyworms (BAW/FAW), tobacco budworm (TBW), grasshoppers, aphids, plant bugs (TPB), stink bugs (SB), whiteflies (WF), soybean looper (SBL), and spider mites.

Pre-mixed products	Pests and Activity of Product (does not imply good control...just activity)										
	Thrips	Cutworms	Aphids	TPB	BAW/FAW	BW/CEW	TBW	SBL	Mites	SB	WF
Argyle	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Leverage	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
Endigo	No	No	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
Brigadier	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
Besiege	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Elevest	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Athena	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Intrepid Edge	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No
Renestra	No	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes

ai = active ingredient; **(R)** = Restricted use; **REI** = re-entry interval; **PHI** = pre-harvest interval

TREATMENT TIPS

- Scout your fields regularly to determine insect population levels and to time insecticide applications.
- Where control problems occur, check your sprayer calibration and insecticide rates to ensure they are correct. *Be especially suspicious of high percentages of bollworms surviving multiple applications of pyrethroids.* Suspected resistance problems should be reported to county agents immediately.
- Use high rates, and avoid low rates.
- Insecticides will be much more effective against bollworms when applied within the first 48 hr after hatch-out.
- Use higher spray volumes during hot weather and when control of bollworms is difficult.
- Applying insecticides in oil may increase their effectiveness during unusually hot weather or during rainy weather.
- Hollow cone nozzles are superior to flat fan nozzles in getting good coverage of leaves and other plant parts. TX6 or TX8 tips provide excellent coverage at 7 to 10 gallons per acre and 50-60 psi.
- CAUTION: It is prohibited to spray blooming cotton with pyrethroids when bees are actively foraging.

COTTON DISEASE CONTROL

John D. Mueller, Extension Cotton Pathologist

SEEDLING DISEASES

Seedling diseases occur on cotton in South Carolina every year. *Rhizoctonia solani* is the most common pathogen with *Pythium* spp. occurring primarily on early-planted cotton or cotton planted on heavy or cool, wet soils. One or both of these seedling pathogens are present in almost every cotton field. Disease incidence and severity in a given field are determined by environmental factors such as soil temperature and moisture, and by seed quality and vigor. Seedling disease management relies on the integration of cultural practices and prudent use of fungicides. There are no varieties that offer any level of resistance to seedling diseases. Crop rotation is also ineffective since *Rhizoctonia solani* and *Pythium* spp. are capable of infecting most commonly grown rotation crops such as corn, peanuts and soybean. The most important cultural practice to limit seedling disease severity is to delay planting until soil temperatures at the 4-inch depth are above 68° F for three consecutive days.

In general, the active ingredients which control *R. solani* do not control *Pythium* spp. and the active ingredients which control *Pythium* spp. do not control *R. solani*. Therefore, using a combination of active ingredients which control the two fungi will provide the highest probability of limiting damage from seedling diseases. If higher levels of protection are desired than are provided by the base treatments provided by seed companies, applying in-furrow fungicides will provide the highest level of control. Liquid, in-furrow fungicides are more effective than granular in-furrow fungicides. Commercially applied additional seed treatments are normally effective except under extremely high disease pressure. Grower-applied seed treatments or hopper-box treatments provide the lowest levels of additional control. The fungicide must be thoroughly mixed with the seed to achieve disease control. Seed treatment products that include fungicides and insecticides are available. Always read the label. Do not use treated seed for feed or food.

FUNGICIDES AVAILABLE FOR COMMERCIAL SEED TREATMENTS.

Fungi controlled	Product	FRAC Code	Active Ingredient	Rate	Application method	Comments
<i>Pythium</i> spp.	Apron XL 3 SC	4	Mefenoxam	0.32 fl. oz.	Commercial seed treatment	Must be applied by commercial seed treaters.
<i>Pythium</i> spp.	Acquire Fungicide Seed Treatment	4	Metalaxyl	0.75 to 1.5 fl. oz. per cwt	Commercial seed treatment	Must be applied by commercial seed treaters.
<i>R. solani</i>	EverGol Prime	7	Penflufen	0.32 - 0.60 fl. oz. per cwt	Commercial seed treatment	Must be applied using commercial slurry or mist-type seed treatment equipment
<i>Fusarium</i> spp. <i>Rhizoctonia</i> spp.	Maxim 4 FS	12	Fludioxonil	0.08 – 0.16 fl. oz. per cwt	Commercial	See label
<i>Fusarium</i> spp. + <i>Pythium</i> spp. + <i>R. solani</i>	Seed Shield Cotton	11 12 4 3	Azoxystrobin Fludioxonil Mefenoxam Difenoconazole	4.0 fl. oz. Per cwt	Commercial seed treatment	Must be applied by commercial seed treaters.
<i>Fusarium</i> spp. + <i>Pythium</i> spp. + <i>R. solani</i>	Trilex Advanced	11 3 4	Trifloxystrobin Triadimenol Metalaxyl	1.6 fl. oz. Per cwt	Commercial seed treatment	Must be applied by commercial seed treaters.

AVAILABLE HOPPER BOX OR SEED TREATMENTS

Fungi controlled	Product	FRAC Code	Active ingredient	Rate	Application Method	Comments
<i>Pythium spp.</i>	Allegiance 2.6 FL	4	Metalaxyl	0.75 – 1.5 oz.	Seed Treatment	See label for specific directions
<i>R. solani</i>	Coronet Fungicide Seed Treatment	11	Pyraclostrobin	5.1 to 6.2 fl. oz.	Seed Treatment	Apply as a water-based slurry using standard slurry or mist-type application equipment.
		7	Boscalid			
<i>Pythium spp. + R. solani</i>	Dynasty CST	11 12 4	Azoxystrobin Fludioxonil Mefenoxam	3.1 -3.95 fl. oz.	Seed treatment	Be sure to thoroughly mix product with seed.
<i>Fusarium spp. + R. solani</i>	Maxim 4FS	12	Fludioxonil	0.08 – 0.16 fl. oz.	Hopper box	Be sure to thoroughly mix product with seed.
See label	Penncozeb 80WP	M3	Mancozeb	3.0 oz.	Hopper box	See label
See label	Penncozeb 75DF	M3	Mancozeb	3.2 oz.	Hopper box	See label
<i>R. solani</i>	Spera 240 FS	3	Myclobutanil	1.25 – 4.0 fl. oz.	Commercial or Hopper box	Available for commercial or hopper box treatments. See label for directions
<i>Fusarium spp. + Pythium spp. + R. solani</i>	Trilex 2000	11	Trifloxystrobin	2.0 fl. oz. Per cwt	Seed treatment	Be sure to thoroughly mix product with seed.
		4	Metalaxyl			
<i>Pythium spp. + R. solani</i>	Trilex Advanced	11 3 4	Trifloxystrobin Triadimenol Metalaxyl	1.6 fl. oz. Per cwt	Commercial seed treatment	Commercial seed treatment only. Not for use in hopper boxes. See label.
<i>R. solani</i>	Vibrance 4.3 FS	7	Sedaxane	0.08- 0.60 fl. oz./cwt	Seed treatment	Be sure to thoroughly mix product with seed.
<i>Pythium spp. + R. solani + Fusarium spp.</i>	Vibrance CST	11 12 4 7	Azoxystrobin Fludioxonil Mefenoxam Sedaxane	3.06 to 4.08 fl. oz./cwt	Seed Treatment	Must be applied as a water-based slurry.
<i>Pythium spp. + R. solani</i>	Vortex 3.77 FS	3	Ipconazole	0.08 fl. oz. Per cwt	Seed Treatment	See label

IN-FURROW FUNGICIDES

Fungus controlled	Product	FRAC Code	Active Ingredient	Rate per 1,000 row ft.	Application Method	Comments
<i>Pythium</i> spp.	Reason 500 SC Fungicide	11	Fenamidone	0.45 fl. oz.	In-furrow liquid spray	Apply in a spray volume of 3 to 5 gal per acre. Direct the spray in-furrow behind seed drop but before furrow closure
<i>Pythium</i> spp.	Ridomil Gold GR	4	Mefenoxam	1.5 – 3.0 Oz	In-furrow granular	Controls only seed rots caused by <i>Pythium</i> spp.
<i>Pythium</i> spp.	Ridomil Gold SL	4	Mefenoxam	0.075- 0.15 Oz.	In-furrow liquid spray	For use primarily in early-planted cotton with cool, wet soils
<i>Pythium</i> spp.	Terramaster 4EC	3	Etridiazole	4.0 to 8.0 fl. oz. per acre based on 40-inch rows	In-furrow liquid spray	Mix with 5 to 15 gallons of water.
<i>R. solani</i>	Headline SC fungicide	11	Pyraclostrobin	0.1 -0.8 fl. oz.	In-furrow Liquid spray	Use a minimum of 2.5 gallons of water per acre. Apply into furrow before seed is covered.
<i>R. solani</i>	Headline fungicide	11	Pyraclostrobin	0.4 – 0.8 fl. oz. /1000 row ft.	In-furrow liquid	Spray a 4- to 8-inch band over seed prior to covering with soil
<i>R. solani</i>	Meteor Fungicide	2	Iprodione	0.25 to 0.5 fl. oz.	In-furrow liquid spray	Apply in at least 2.5 gal. water per acre to deliver in an open seed furrow
<i>R. solani</i>	Proline 480 SC	3	Prothioconazole	0.4 to 0.5 fl. oz./1000 row ft.0	In-furrow liquid spray	May also be applied in a 4- to 6- inch band over the row at or near emergence
<i>R. solani</i>	Rovral 4 Flowable Fungicide	2	Iprodione	0.25 – 0.5 fl. oz. /1000 row ft.	In-furrow	Apply at planting as a banded spray over the seed and covering soil
<i>R. solani</i> + <i>Pythium</i> spp.	Priaxor® Xemium brand fungicide	7 11	Fluxapyroxad Pyraclostrobin	0.1 – 0.6 fl. oz. /1000 row ft	In-furrow liquid	Provides suppression only of <i>Pythium</i> spp.
<i>R. solani</i> + <i>Pythium</i> spp.	Quadris Flowable Fungicide	11	Azoxystrobin	0.40 – 0.80 oz. /1000 row ft.	In-furrow liquid	Apply as a spray in 5 to 15 gal. of water over the open furrow at planting to the soil around the seed and covering soil.
<i>R. solani</i> + <i>Pythium</i> spp.	Uniform	11 4	Azoxystrobin Mefenoxam	0.32 – 0.48 fl. oz. /1000 ft. row	In-furrow spray	Apply as an in-furrow spray in 5 to 15 gallons of water per acre at planting.

LEAF SPOTS AND BOLL ROTTS

Most cotton leaf spots caused by fungi are not severe enough in South Carolina to warrant fungicide applications. In many cases disease severity is linked to nutrient deficiencies, especially shortages of potassium. This group would include *Alternaria* leaf spot, *Ascochyta* blight, *Cercospora* leaf spot, *Phoma* blight, and *Stemphylium* leaf spot. Spraying a fungicide for these foliar diseases is usually not cost effective. In recent years Target Spot, caused by *Corynespora cassiicola*, has become common in some areas of the Southeastern United States. It is often linked to areas with excessive rainfall in midseason, especially if rank growth is present. There are fungicides labeled for Target Spot control. However, reliable application timings and rates have not been established. Always read the label for appropriate application rates. Aereolate mildew caused by *Ramularia areola* is a relatively new fungal leaf disease of cotton in South Carolina. The first year we had significant reports of this disease was 2018. Like Target spot it is favored by excessive rainfall in midseason and rank plant growth. Yield losses from this disease have been reported in other areas and we definitely observed yield losses in 2021 in South Carolina. Aereolate mildew appears to be more easily controlled by fungicides than Target Spot. For both Target Spot and Aereolate mildew, fungicides must be sprayed at the first sign of the disease to achieve significant control. A third foliar disease has reappeared in South Carolina after being absent at significant levels for many years. Bacterial blight has been common in Georgia since 2015. It is caused by a bacterium *Xanthomonas citri* pv. *malvacearum*. Therefore, fungicides are ineffective against it. However, unlike Target Spot or Aereolate Mildew cultivars with well-defined resistance to bacterial blight exist. If you are concerned with Bacterial Blight, be sure to plant a resistant variety. In the past two years a fourth disease has appeared in South Carolina and the Southern United State, Cotton Blue Disease. This disease is caused by a virus. We have no pesticides which are capable of directly controlling a virus disease. Fungicides are not effective against viruses.

Boll rots are caused by many different fungi. These include *Alternaria* boll rots, Anthracnose boll rot, *Ascochyta* boll rot, *Diplodia* boll rot, and *Phoma* boll rot. Many boll rots are caused by bacteria and cannot be controlled by a fungicide. Like leaf spots, control of boll rots with fungicides is difficult to achieve. In many cases feeding by stink bugs and other insects provide pathways for otherwise weakly pathogenic fungi to enter the boll and cause boll rotting.

FUNGICIDES FOR FOLIAR APPLICATIONS ON COTTON

Product	Product	FRAC CODE	Rate	Re-entry interval	Comments
Amistar Top	Azoxystrobin + Difenconazole	11 + 3	8.0 – 11.6 fl. oz. per acre	12 hrs.	45 day preharvest interval. Do not apply more than 34.8 fl. oz./acre per year. See label for restrictions on total applications of each active ingredient.
AzoxyStar	Azoxystrobin	11	6.0 -9.0 fl. oz. per acre	12 hrs.	45-day preharvest interval. Do not apply more than 27 fl. oz. of product/crop/season.
Elatus Fungicide	Azoxystrobin + Benzovindiflupyr	11 + 7	5.0 – 7.3 fl. oz. per acre	12 hrs.	45 day preharvest interval. Only two applications are allowed.
Headline fungicide	Pyraclostrobin	11	6.0 – 12.0 fl. oz. per acre	12 hrs.	30 day preharvest interval. Two applications are allowed
Headline SC fungicide	Pyraclostrobin	11	6.0 – 12 fl. oz. per acre	12 hrs.	30 day preharvest interval. Two applications are allowed
Miravis Top 1.67 SC	Difenoconazole + Pydiflumetofen	3 7	13.6 fl. oz. per acre	12 hrs.	45 day preharvest interval See supplemental label
Priaxor Xemium Brand Fungicide	Pyraclostrobin + Fluxapyroxad	11 + 7	4.0 – 8.0 fl. oz. per acre	12 hrs.	30 day preharvest interval. Maximum application of 24 fl. oz. per acre per season. Maximum 3 applications per season.
Proline 480 SC Fungicide	Prothioconazole	3	5.0 – 5.7 fl. oz. per acre	12 hrs.	30 day preharvest interval. See label for limitations on applications per season.
Quadris Flowable Fungicide	Azoxystrobin	11	6.0 – 9.0 fl. oz. per acre	12 hrs.	45 day preharvest interval. Maximum application of 27 fl. oz./acre/season
Topguard EQ FUNGICIDE	Azoxystrobin + flutriafol	11 + 3	7 to 14 oz. per acre	12 hrs.	30 day preharvest interval. Only 2 applications allowed per year.
TwinLine Fungicide	Pyraclostrobin metconazole	11 3	7.0 – 8.5 fl. oz. per acre	12 hrs.	30-day preharvest interval. Three applications are allowed. Maximum use rate is 26 fl. oz. per acre per season.

COTTON NEMATODE CONTROL

John D. Mueller, Extension Cotton Pathologist

Nematodes pose a serious threat to cotton production in South Carolina. Not every field is infested with damaging levels of nematodes. However, in the fields that are infested, yield losses range from barely detectable to over 50%. Almost half of all fields have at least one nematode species present over damage threshold levels. Management tools for any of the three major nematode species are limited. Crop rotation can be an effective tool, especially if peanut is the rotation crop. Rotation to peanut will reduce levels of Southern root-knot, reniform and Columbia lance nematodes. Corn will reduce levels of reniform, but not Southern root-knot or Columbia lance nematodes. In-row subsoiling and other forms of deep tillage will allow more vigorous root growth, resulting in less damage and yield losses from all plant-parasitic nematodes. In the last several years cotton varieties that are resistant/tolerant to Southern root-knot nematode have become available but are very limited in number. This resistance is effective only against Southern root-knot nematode. Be sure to check company information sheets to be sure which varieties are and are not resistant. In 2021 PhytoGen and Deltapine both released cotton varieties resistant to both Southern root-knot and reniform nematodes. For information on cotton nematode management using host plant resistance, crop rotation, cover crops, or planting dates see the latest Cotton Production Guide.

Nematicide Use: Nematicides are broken out into two major groups based on nematode pressure. The first group is for use in fields with high nematode population levels. Telone II is the only “stand alone” nematicide for fields with heavy nematode pressure. It is applied as a pre-plant fumigant. Other treatment regimens for fields with heavy nematode pressure include AgLogic 15G or Velum Total in-furrow, at-planting plus post-emergence applications of AgLogic 15G side-dressed or Return XL or Vydate C-LV sprayed over the top. The second group of nematicides can be used in fields with low to moderate nematode pressure. It includes AgLogic 15G in-furrow at-planting and commercial seed treatments including AVICTA Complete Pak, AERIS Seed Treatment System, or COPeO Prime. COPeO Prime contains fluopyram, the active ingredient in Velum. AVICTA Complete Pak contains a nematicide (Abamectin), an insecticide (Cruiser) and a combination of fungicides (Dynasty CST). AERIS Seed Treatment System contains a nematicide (Larvin) and an insecticide (Gaucho Grande). The inclusion of Trilex Advanced Seed Applied System fungicides is optional. Return XL or Vydate C-LV can also be applied post-emergence in combination with at-plant treatments of AgLogic 15G, Velum Total or seed treatments such as AVICTA Complete Pak or AERIS Seed Treatment System for additional control in fields with low to moderate nematode pressure.

FUMIGANT, GRANULAR, AND LIQUID NEMATOCIDES AVAILABLE IN SOUTH CAROLINA FOR CONTROL OF NEMATODES ON COTTON. SEE LABELS FOR SPECIFIC SPECIES CONTROLLED BY EACH PRODUCT.

Nematode level	Product	Rate/acre for 38-inch rows	Application Method	Re-entry interval	Comments
High	Telone II	3.0 – 5.0 gal.	Pre-plant fumigant	5 days	Should be injected under the row so that after bedding there are at least 14-inches between the release point and the soil surface. A minimum waiting period of 10 to 14 days is needed prior to planting. Additional materials are needed for thrips control.
High	AgLogic 15G & AgLogic 15GG	5.0 lbs.	Post – emergence side-dressed	48 hours	To control high levels of nematodes, apply as a split application, in-furrow + side dress. Apply side dress in a furrow that is 6 to 12 inches to one or both sides of the plant row to a depth of 2 to 3 inches.
Low to Moderate	Velum	5.0 to 6.84 fl. oz.	In-furrow At-plant	12 hrs.	Apply as in-furrow spray with 5 to 6 gal./acre of water at planting. Contains an insecticide-imidacloprid, plus a fungicide/nematicide-fluopyram
Moderate to High	Vydate C-LV	8.5 – 17.0 fl. oz.	Post-emergence	48 hrs.	Apply 2- to 4-weeks after emergence as a band over the row or broadcast. Always apply in combination with an at-plant or pre-plant nematicide.
Moderate to High	Return XL	8.5 – 17.0 fl. oz.	Post – emergence	48 hrs.	Apply 2- to 4-weeks after emergence as a band over the row or broadcast. Always apply in combination with an at-plant or pre-plant nematicide. See label for application options.
Low to Moderate	AgLogic 15G & AgLogic 15G	3.5 to 6.0 lbs.	In-furrow at-plant	48 hrs.	Apply granules in the seed furrow and immediately cover with soil by mechanical means.

NEMATOCIDES AVAILABLE IN SOUTH CAROLINA AS COMMERCIAL SEED TREATMENTS FOR CONTROL OF LOW TO MODERATE LEVELS OF NEMATODES. SEE LABELS FOR SPECIFIC SPECIES CONTROLLED BY EACH PRODUCT.

Nematode level	Product	Application Method	Re-entry interval	Comments
Low to Moderate	AERIS Seed-Applied Insecticide/Nematicide	Available only as a commercial seed treatment	Not applicable	Contains a nematicide (Thiodicarb 24%) and an insecticide (Imidacloprid 24%). See label for further information.
Low to Moderate	Avicta 500 FS	Available only as a commercial seed treatment	Not Applicable	Contains only a nematicide, Abamectin.
Low to Moderate	Avicta Duo Cotton	Available only as a commercial seed treatment	Not applicable	Contains a nematicide (Abamectin at 12.4%) and an insecticide (Thiamethoxam at 28.1%). See label for further information.
Low to Moderate	Avicta Duo COT202	Available only as a commercial seed treatment	Not applicable	Contains a nematicide (Abamectin at 11.2%) and an insecticide (Thiamethoxam at 28.0%). See label for further information.
Low to Moderate	BioST Nematicide 100	Commercial seed treatment or seed dressing at plant	Not applicable	Contains heat killed <i>Burkholderia</i> spp. Strain A396 cells and spent fermentation media. Apply at 8 oz. per 100 lbs. of seed.
Low to Moderate	COPeO Prime	Available only as a commercial seed treatment	Not applicable	Contains a nematicide (fluopyram at 48.4%) that may also act as a fungicide.
Low to Moderate	PONCHO/VOTiVO	Available only as a commercial seed treatment	Not applicable	Contains a nematicide (<i>Bacillus firmus</i> I1582 at 8.10%) and an insecticide (Clothianidin at 40.3%). See label for further information.

WEED CONTROL IN FORAGE LEGUMES

Mike Marshall, Extension Weed Specialist

Preplant Incorporated Herbicides for Weed Management in Seedling Forage Legumes

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>benefin</i>		1.2 lb	15	--	12 hours
Balan 60DF	2.0 lb				

Comments: Labeled for Alfalfa, Birdsfoot Trefoil, and Clovers. Incorporate BALAN into the upper (2-3 inches) soil surface up to 3 weeks days before planting. BALAN must be incorporated within 8 hours of surface application. If BALAN is applied to warm, wet soils or if wind velocity is consistently greater than 10 mph, variable weed control may result. A tandem disc or PTO driven tillage equipment (i.e., tillers, cultivators, or hoes) is the recommended equipment for incorporation of BALAN. Two passes in different directions are required for incorporation of BALAN with a tandem disc. PTO driven tillage equipment operated in coarse textured soils may result in uneven distribution of BALAN due to excess soil being deposited into the wheel tracks from the middles.

<i>EPTC</i>			8	14 days	12 hours
Eptam 20G	15 lb	3.0 lb			
Eptam 7E	2.25-4.5 pt	2.0-3.9 lb			

Comments: Labeled for Alfalfa, Birdsfoot Trefoil, Clovers, and Lespedeza. Uniformly incorporate EPTAM immediately after application, preferably conduct incorporation and application in the same operation, in the top 2 to 3 inches of the soil profile prior to planting. Use power driven cultivation equipment set to a depth of 2 to 3 inches or a tandem disc set to a depth of 4 to 6 inches operated at 4 to 6 mph followed by a spike-tooth harrow or other leveling device which extends beyond the ends of the disc. Seeding of the legumes should occur as soon as possible after application of EPTAM. Do not use EPTAM if grass or grain nurse crop is to be planted with the legume. Do not use on white Dutch clover.

Preemergence Herbicides for Weed Management in Seedling Forage Legumes

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>norflurazon</i>		1.0-2.0 lb	12	28 days	12 hours
Solicam 80DF	1.25-2.5 lb				

Comments: Labeled for Alfalfa only. Apply SOLICAM to seedling alfalfa after it has emerged and been actively growing for 3 months. Use the lower rate on coarse textured soils (sand, loamy sand, and sandy loam). Use the higher rate on medium textured soils (loam through sandy clay) and when heavier weed pressure is expected. Do not apply more than 2.5 lbs in a single application or in split applications. SOLICAM may be tank mixed with 2,4-DB, GRAMOXONE, PURSUIT, VELPAR, SINBAR, METRIBUZIN, EPTAM, POAST, KERB, and KARMEX.

<i>pendimethalin</i>		0.52-1.0 lb	3	14 days	24 hours
Prowl H20 3.8AS	1.1-2.1 pt				

Comments: Labeled for Alfalfa only. Apply to seedling alfalfa from the second trifoliolate growth stage but before it 6 inches in height. Applications made after 6-inch heights may result in poor weed control because of reduced spray coverage to the soil.

POST Herbicides for Weed Management in Seedling Forage Legumes (1st year)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>imazamox</i> Raptor 1AS	4.0-6.0 fl oz	0.031-0.047 lb	2	None	4 hours
Comments: Labeled for Alfalfa only. Apply RAPTOR as a broadcast spray to seedling alfalfa after the 2nd trifoliolate has fully expanded and most weeds are 1 to 3 inches in height. Use the higher rate range for larger weeds. Seedling alfalfa may exhibit temporary reduction in growth after an application of RAPTOR. Do not apply more than one RAPTOR application per year to alfalfa. Do not apply more than 6 fl oz/A to alfalfa per year (growing season). Do not make sequential applications of PURSUIT followed by RAPTOR (or vice versa) within a 60-day period during the growing season due to an increased potential crop response. Add COC or MSO at 1 to 2 gallons/100 gallons of spray solution or a NIS at 1 qt/100 gallons of spray solution plus nitrogen-based fertilizer, such as 28% N or UAN at 2.5 gallons/100 gals of spray solution or AMS at 12 to 15 lbs/100 gals of spray solution is required. Rainfast interval = 1 hour.					
<i>imazethapyr</i> Pursuit 2AS	3.0-6.0 fl oz	0.047-0.094 lb	2	30 days	4 hours
Comments: Labeled for Alfalfa and Clovers. Apply PURSUIT as a broadcast spray to seedling alfalfa or clover after the 2nd trifoliolate has fully expanded and most weeds are 1 to 3 inches in height. Use the higher rate range for larger weeds. Seedling alfalfa or clover may exhibit temporary reduction in growth or leaf yellowing after an application of PURSUIT. The addition of COC at 1.0% v/v or MSO at 1.0% v/v or NIS at 0.25% v/v is required. Do not apply more than 6 fl oz/A of PURSUIT per year to alfalfa or clover. Do not feed, graze, or harvest alfalfa or clover for 30 days following application of PURSUIT. Rainfast interval = None.					
<i>glyphosate (various)</i>	22-44 fl oz.	0.75-1.5 lb ae	9	5 days	4 hours
Comments: USE ONLY ON GLYPHOSATE-TOLERANT ALFAFLA VARIETIES! Apply GLYPHOSATE at 0.75 to 1.5 lb ae/A over-the-top of seedling alfalfa from emergence up to 5 days before cutting. Up to 10 percent of the alfalfa seedlings will not contain the Roundup Ready gene and not survive the first application of GLYPHOSATE. To eliminate effects of stand gaps created by the loss of these plants, make a single application of GLYPHOSATE before the 4-trifoliolate stage in new stands. Controls annual grasses and broadleaves. In general, the first over-the-top broadcast application should be applied early to minimize weed competition on seedling alfalfa. Tank mix partners include POAST, POAST PLUS, SELECT, SELECT MAX, RAPTOR, or PURSUIT. Rainfast interval = 4 hours.					
<i>paraquat 2SL</i>	0.75-1.25 pt	0.188-0.31 lb	22	60 days	12 hours
<i>paraquat 3SL</i>	0.5-0.8 pt	0.188-0.30 lb			
Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Labeled for alfalfa only. Apply PARAQAT in a minimum of 10 gallons of water (15-20 GPA is preferred for best activity on target weeds) immediately after cutting for hay or grazing for control of small annual broadleaf and grass weeds. Add NIS at 1 qt per 100 gal of spray solution. Do not apply if regrowth after grazing or cutting for hay is more than 2 inches. Do not make more than one application per year. Rainfast interval = 30 minutes.					
<i>pendimethalin</i> Prowl H20 3.8AS	1.1-4.2 qt	1.1-4.0 lb	3	14 days	24 hours
Comments: Labeled for Alfalfa only. Apply to established alfalfa in a single application or in sequential applications before the canopy reaches 6 inches in height. Application timings include fall after the last cutting/mowing, during winter dormancy, in the spring, or between cuttings. Applications made after 6-inch heights could result in poor weed control because of reduced spray coverage to the soil.					

POST Herbicides for Weed Management in Seedling Forage Legumes (1st Year) [cont]

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>pronamide</i> Kerb 50W	1.0-3.0 lb	0.5-1.5 lb	3	120 days	24 hours
<p>Comments: <i>Labeled for Alfalfa, Birdsfoot Trefoil, Crown Vetch, and Clovers.</i> Apply KERB in a minimum of 20 gallons per acre as a postemergence residual after the seedling legume has reached the trifoliolate growth stage in the fall. Optimum herbicidal activity occurs when applications are made under cool temperature conditions (55-60F) and are followed by rainfall or irrigation. KERB must be applied before soils freeze-up. KERB has postemergence activity on bluegrass, foxtail barley, chickweed, and Italian ryegrass, but most activity provided after application is residual. Use the higher rate range for larger weeds. Do not apply more than 4 lb KERB per acre per year. Do not graze or harvest for forage or dehydration within 120 days following application of the KERB application. Rainfast interval = None.</p>					
<i>sethoxydim</i> Poast 1.5E Poast Plus 1E	1.0-1.5 pt 1.5-2.25 pt	0.19-0.28 lb	1	7 days (undried) 14-20 days (dried)	12 hours
<p>Comments: <i>Labeled for Alfalfa, Birdsfoot Trefoil, and Clovers.</i> Apply POAST or POAST PLUS anytime during seedling legume growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply POAST at 1.5 pt/A (2.25 pt/A POAST PLUS) up to 25" tall. A second application of POAST at 1.0 pt/A (1.5 pt/A POAST PLUS) may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A of POAST (2.25 pt/A POAST PLUS), and then apply a second application of 1.0 pt/A of POAST (1.5 pt/A POAST PLUS) to 4" re-growth. Add MSO at 1.5 pt/A or COC 2 pt/A plus UAN at 4-8 pt/A or AMS at 2.5 lb/A for enhanced crabgrass activity. Do not add UAN or AMS to a tank mix of POAST/POAST PLUS plus 2,4-DB. Do not apply within 7 days of grazing or feeding (undried) or 14 days of cutting for hay (20 days for clover hay) [dried]. Do not tank mix 2,4-DB with POAST/POAST PLUS when applying to clover. There is no grazing or feeding restrictions following application of POAST/POAST PLUS. Do not apply more than 2.5 pt/A of POAST per application. Do not apply more than 6.5 pt/A of POAST per season. Do not apply more than 3.75 pt/A of POAST PLUS per application. Do not apply more than 9.75 pt/A of POAST PLUS per season. Rainfast interval = 1 hour.</p>					
<i>trifluralin</i> Treflan 4HFP	4.0 pt	2.0 lb	3	21 days	12 hours
<p>Comments: <i>Labeled for Alfalfa only.</i> Apply TREFLAN immediately after a cutting/mowing or during the dormant season in the fall or winter. Do not apply more than 4.0 pt/A during any growing season. Rainfall or irrigation of at least 0.5 inch is required after application for optimum weed control. TREFLAN will not control existing weeds. Do not apply to actively growing alfalfa.</p>					

POST Herbicides for Weed Management in Seedling Forage Legumes (1st Year) [cont]

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
2,4-DB 2S	2.0-6.0 pt	0.5-1.5 lb	4	30 days	48 hours

2,4-DB 1.75S 4.33-6.5 pt 0.95-1.4 lb

Comments: Labeled for Alfalfa only. Apply 2,4-DB as a broadcast spray to seedling alfalfa when it has reached the 1 to 2 trifoliolate growth stage to control selected broadleaf weeds (for best results, target weeds less than 1 inch in height) including annual morningglory, cocklebur, pigweed, and wild mustard. Use the higher rate range for weeds up to 3 inches in height. For suppression of curly dock and smartweed (up to 3 inches in height), apply the highest labeled rate for the 2,4-DB product. Apply to actively growing alfalfa. Twisting and/or malformation of the stems and leaves may occur after application, but alfalfa will outgrow this response. The addition of a NIS at 0.25 %v/v may improve weed control results. Wild mustard and radish that has overwintered may not be controlled by 2,4-DB. Do not graze or feed seedling alfalfa to meat or dairy livestock within 60 days of application. Do not spray when crop is stressed from lack of moisture. Do not spray when temperature exceeds 90F and/or is predicted to exceed 90F during the three days following application. Rainfall or overhead irrigation within 7 to 10 days of application of 2,4-DB can cause unacceptable crop injury. **Rainfast interval = None.**

POST Herbicides for Weed Management in Established Forage Legumes (>1 Year)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>clethodim</i>		0.091-0.25 lb	1	15 days	12 hours

Select 2EC 10.0-16.0 oz
 Select MAX 0.97EC 12.0-32.0 oz

Comments: Labeled for use in Alfalfa and Clovers. Apply in a minimum of 10 gallons per acre anytime during established forage legume growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply SELECT at 10 oz/A (12-14 oz/A SELECT MAX) up to 24" tall. For bermudagrass, treat when 6" runners are present with SELECT at 10 oz/A (16 oz/A SELECT MAX). Use the higher rate when heavy infestations of perennial grasses are present. Repeat applications may be needed for perennial grasses with large crowns. Wait a minimum of 14 days between applications. Add COC at 1 qt/A plus AMS at 2.5-4.0 lb/A for enhanced perennial grass activity. SELECT/SELECT MAX may be tank mixed with 2,4-DB, PURSUIT, RAPTOR (SELECT MAX only) or BUCTRIL herbicides and ASANA XL (SELECT MAX only) BAYTHROID, DANNITOL (SELECT MAX only), DIMETHOATE, LORSBAN, ORTHENE (SELECT MAX only), POUNCE, and WARRIOR insecticides. **Rainfast interval = 1 hour.**

glyphosate 22-44 fl oz. 0.75-1.5 lb ae 9 5 days 4 hours

Comments: FOR USE ONLY ON ALFAFLA VARIETIES DESIGNATED AS ROUNDUP READY! Apply GLYPHOSATE at 0.75 to 1.5 lb ae/A over-the-top of actively growing, established alfalfa from emergence up to 5 days before cutting. Apply GLYPHOSATE after weeds have emerged but before alfalfa growth or re-growth interferes with spray coverage of weeds. Controls annual grasses and broadleaves. Do not exceed 44 fl oz/A of GLYPHOSATE per single in-crop application. Sequential applications must be made a minimum of 7 days apart. Do not exceed 4.1 qt/A (132 fl oz/A) of in-crop applications per year. Remove livestock before application. Tank mix partners include ASSURE II, POAST, PURSUIT, RAPTOR, or SELECT MAX. **Rainfast interval = 4 hours.**

POST Herbicides for Weed Management in Established Forage Legumes (>1 Year) [cont]

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>imazethapyr</i> Pursuit 2AS	3.0-6.0 fl oz	0.047-0.094 lb	2	30 days	4 hours
<p>Comments: Labeled for use in Alfalfa and Clovers. Apply PURSUIT as a broadcast spray to established alfalfa or clover (> 1 year old) after the 2nd trifoliolate has fully expanded (but before 3 inches of regrowth has occurred to ensure adequate spray coverage of the target weeds). Use the higher rate range for larger weeds (>3 inches in height). Alfalfa or clovers may exhibit temporary reduction in growth or leaf yellowing if PURSUIT is applied under cool conditions (<40 F). The addition of COC at 1.0% v/v or MSO at 1.0% v/v or NIS at 0.25% v/v is required. Do not apply more than 6 fl oz/A of PURSUIT per year to alfalfa or clover. Do not apply more than 4 fl oz of PURSUIT during last year of the stand. Do not feed, graze, or harvest alfalfa or clover for 30 days following application of PURSUIT. Rainfast interval = None.</p>					
<i>sethoxydim</i> Poast 1.5E Poast Plus 1E	1.0-1.5 pt 1.5-2.25 pt	0.19-0.28 lb	1	7 days (undried) 14-20 days (dried)	12 hours
<p>Comments: Labeled for use in Alfalfa, Birdsfoot Trefoil, and Clovers. Apply POAST or POAST PLUS anytime during established forage legume growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply POAST at 1.5 pt/A (2.25 pt/A POAST PLUS) up to 25" tall. A second application of POAST at 1.0 pt/A (1.5 pt/A POAST PLUS) may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A of POAST (2.25 pt/A POAST PLUS), and then apply a second application of 1.0 pt/A of POAST (1.5 pt/A POAST PLUS) to 4" re-growth. Add MSO at 1.5 pt/A or COC 2 pt/A plus UAN at 4-8 pt/A or AMS at 2.5 lb/A for enhanced crabgrass activity. Do not add UAN or AMS to the tank mix of POAST/POAST PLUS plus 2,4-DB. Do not apply within 7 days of grazing or feeding (undried) or 14 days of cutting for hay (20 days for clover hay) [dried]. Do not tank mix 2,4-DB with POAST/POAST PLUS when applying to clover. There is no grazing or feeding restrictions following application of POAST/POAST PLUS. Do not apply more than 2.5 pt/A/application or 6.5 pt/A/season of POAST. Do not apply more than 3.75 pt/A/application or 9.75 pt/A/season of POAST PLUS. Rainfast interval = 1 hour.</p>					
<i>2,4-DB 2S</i>	2.0-6.0 pt	0.5-1.5 lb	4	30 days	48 hours
<i>2,4-DB 1.75S</i>	4.33-6.5 pt	0.95-1.4 lb			
<p>Comments: Labeled for Alfalfa only. Apply 2,4-DB as a broadcast spray to actively growing, established alfalfa (>1 year old) to control small (<1 inch) broadleaf weeds including annual morningglory, cocklebur, pigweed, and wild mustard. Use the higher rate range for weeds up to 3 inches in height. For suppression of curly dock and smartweed (up to 3 inches in height), apply the highest labeled rate for the 2,4-DB product. Established alfalfa is less tolerant of 2,4-DB than in the seedling growth stage. Twisting and/or malformation of the stems and leaves may occur after application, but alfalfa will outgrow this response. The addition of a NIS at 0.25 %v/v may improve weed control results. Wild mustard and radish that has overwintered may not be controlled by 2,4-DB. Do not spray when crop is stressed from lack of moisture. Do not spray when temperature exceeds 90F and/or is predicted to exceed 90F during the three days following application. Rainfall or overhead irrigation within 7 to 10 days of application of 2,4-DB can cause unacceptable crop injury. Rainfast interval = None.</p>					

POST Herbicides for Weed Management in Established Forage Legumes (Between Cuttings)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>flumioxazin</i> Chateau 51WDG	4.0 oz	0.128 lb	14	25 days	12 hours
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Comments: Labeled for Alfalfa only. For residual control of summer annual weeds, the optimum timing is in the spring before initiation of alfalfa growth (less than 6 inches in height). CHATEAU may be tank mixed with PARAQUAT for enhanced burndown of winter and summer annuals in the fall after last cutting or in the summer between cuttings. Do not use on mixed alfalfa-grass stands. Do not make sequential applications of CHATEAU within 60 days of the first application. Do not apply more than 8 fl oz/A of CHATEAU per growing season.

<i>imazamox</i> Raptor 1AS	4.0-6.0 fl oz	0.031-0.047 lb	2	None	4 hours
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Comments: Labeled for use in Alfalfa only. Apply RAPTOR as a broadcast spray to established alfalfa (> 1 year old) following cutting and removal of hay or silage from the field. Apply PURSUIT before significant alfalfa or clover regrowth (3 inches) following cutting. Use the higher rate range for larger weeds (>3 inches in height). Do not apply more than one RAPTOR application per year to alfalfa. Do not apply more than 6 fl oz/A to alfalfa per year (growing season). Do not make sequential applications of RAPTOR followed by PURSUIT (or vice versa) within a 60-day period during the growing season due to an increased potential crop response. Add COC or MSO at 1 to 2 gallons/100 gallons of spray solution or a NIS at 1 qt/100 gallons of spray solution plus nitrogen-based fertilizer, such as 28% N or UAN at 2.5 gallons/100 gals of spray solution or AMS at 12 to 15 lbs/100 gals of spray solution is required. **Rainfast interval = 1 hour.**

<i>imazethapyr</i> Pursuit 2AS	3.0-6.0 fl oz	0.047-0.094 lb	2	30 days	4 hours
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Comments: Labeled for use in Alfalfa and Clovers. Apply PURSUIT as a broadcast spray to established alfalfa or clover (> 1 year old) following cutting and removal of hay or silage from the field. Apply PURSUIT before significant alfalfa or clover regrowth (3 inches) following cutting. Use the higher rate range for larger weeds (>3 inches in height). Alfalfa or clovers may exhibit temporary reduction in growth or leaf yellowing if PURSUIT is applied under cool conditions (<40 F). The addition of COC at 1.0% v/v or MSO at 1.0% v/v or NIS at 0.25% v/v is required. Do not apply more than 6 fl oz/A of PURSUIT per year to alfalfa or clover. Do not apply more than 4 fl oz of PURSUIT during last year of the stand. Do not feed, graze, or harvest alfalfa or clover for 30 days following application of PURSUIT. **Rainfast interval = None.**

<i>norflurazon</i> Solicam 80DF	1.25-2.5 lb	1.0-2.0 lb	12	28 days	12 hours
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Comments: Labeled for Alfalfa only. Apply SOLICAM in established alfalfa (>1-year-old) following mowing or cutting to ensure spray reaches the soil surface. SOLICAM may also be applied in dormant alfalfa if the stand is not actively growing. Do not apply SOLICAM to seedling alfalfa until it has emerged and been actively growing for 3 months. Use the lower rate on coarse textured soils (sand, loamy sand, and sandy loam). Use the higher rate on medium textured soils (loam through sandy clay) and when heavier weed pressure is expected. Do not apply more than 2.5 lbs in a single application or in split applications. SOLICAM may be tank mixed with 2,4-DB, GRAMOXONE, PURSUIT, VELPAR, SINBAR, METRIBUZIN, EPTAM, POAST, KERB, and KARMEX.

POST Herbicides for Weed Management in Est. Forage Legumes (Between Cuttings) [cont]

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

paraquat 2SL 1.0 pt 0.25 lb 22 30 days 12 hours

paraquat 3SL 0.7 pt 0.26 lb

Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. *Labeled for use in alfalfa only.* Apply PARAQUAT to after alfalfa has been removed for hay or silage in a minimum of 10 gallons of water (15-20 GPA is preferred for best activity on target weeds). Do not treat more than 5 days after cutting. For established stands, make 1 to 3 applications as needed to control small seeding weeds present after hay or silage removal. Do not make more than 2 applications during the first growing season. Provides control of small annual broadleaf and grass weeds. Crop foliage present at time of application will be burned. Add NIS at 1 qt per 100 gal of spray solution. **Rainfast interval = 30 minutes.**

POST Herbicides for Weed Management in Dormant Forage Legumes (>1 Year)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

hexazinone 0.5-0.75 lb 5 30 days 48 hours

Velpar 2L 2.0-3.0 pt

Velpar 75DF 0.67-1.0 lb

Comments: *Labeled for Alfalfa only.* Apply VELPAR as a broadcast spray to dormant established alfalfa (>1-year-old) during the fall, winter, or early spring months before significant growth or regrowth (<2 inches) has occurred. Add NIS at 1 qt per 100 gallons of spray solution for enhanced control of emerged weeds at the time of application. Provides control and/or suppression of chickweed, henbit, deadnettle, field pennycress, wild mustard, wild radish, corn spurry, and shepherdspurse. Do not apply within 30 days of harvest (cutting for hay) or feeding of forage or grazing. Do not exceed 1.5 lb ai *hexazinone* per acre per application/year.

flumioxazin 0.128 lb 14 25 days 12 hours

Chateau 51WDG 4.0 oz

Comments: *Labeled for Alfalfa only.* For residual control of winter annual weeds, the best preemergence timing is in the fall after the last cutting has occurred. For residual control of summer annual weeds, the optimum timing is in the spring before initiation of alfalfa growth (less than 6 inches in height). CHATEAU may be tank mixed with PARAQUAT for enhanced burndown of winter and summer annuals in the fall after last cutting or in the summer between cuttings. Do not use on mixed alfalfa-grass stands. Do not make sequential applications of CHATEAU within 60 days of the first application. Do not apply more than 8 fl oz/A of CHATEAU per growing season.

imazamox 0.031-0.047 lb 2 None 4 hours

Raptor 1AS 4.0-6.0 fl oz

Comments: *Labeled for Alfalfa only.* Apply RAPTOR as a broadcast spray to dormant established alfalfa (>1 year old) during the fall, winter, or early spring months before significant growth or regrowth (<3 inches) has occurred which allows RAPTOR to reach the target weeds. Target application when most of the weeds present are 1 to 3 inches in height. Use the higher rate range for larger weeds. Do not apply more than one RAPTOR application per year to alfalfa. Do not apply more than 6 fl oz/A to alfalfa per year (growing season). Add COC or MSO at 1 to 2 gallons/100 gallons of spray solution or a NIS at 1 qt/100 gallons of spray solution plus nitrogen-based fertilizer, such as 28% N or UAN at 2.5 gallons/100 gals of spray solution or AMS at 12 to 15 lbs/100 gals of spray solution is required. **Rainfast interval = 1 hour.**

POST Herbicides for Weed Management in Dormant Forage Legumes (>1 Year) [cont]

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>metribuzin</i>		0.25-0.375 lb	5	28 days	12 hours
Metribuzin 75DF	5.33-8.0 oz				
<p>Comments: Labeled for Alfalfa only. Apply METRIBUZIN dormant established alfalfa (>1 year old) in a minimum of 10 gallons per acre as a postemergence residual during the fall or winter months following the last cutting or grazing. Provides control and/or suppression of chickweed, henbit, deadnettle, rescuegrass, downy brome, field pennycress, and shepherdspurse. Use lower rates on coarse textured soils with less than 1% organic matter. Do not apply METRIBUZIN after alfalfa growth begins in the spring or before growth ceases in the fall. For best results, apply when weeds are less than 2 inches tall or before weed foliage is 2 inches in diameter.</p>					
<i>paraquat</i> 2SL	1.0-2.0 pt	0.25-0.50 lb	22	60 days	12 hours
<i>paraquat</i> 3SL	0.7-1.3 pt	0.26-0.49 lb			
<p>Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Labeled for alfalfa only. Apply PARAQUAT to dormant established alfalfa (>1-year-old) in a minimum of 10 gallons of water (15-20 GPA is preferred for best activity on target weeds) during the fall or winter months after the last cutting but before regrowth of new green foliage in the spring. Provides control of small winter annual broadleaf and grass weeds. Tank mix METRIBUZIN with PARAQUAT for enhanced activity on existing weed vegetation and residual weed control in dormant established alfalfa. Add NIS at 1 qt per 100 gal of spray solution. Do not make more than one application per year. Rainfast interval = 30 minutes.</p>					
<i>pronamide</i>		0.5-1.5 lb	3	120 days	24 hours
Kerb 50W	1.0-3.0 lb				
<p>Comments: Labeled for Alfalfa, Birdsfoot Trefoil, Crown Vetch, and Clovers. Apply KERB in a minimum of 20 gallons per acre as a postemergence residual during the fall or winter months following the last cutting or grazing after daytime temperature has fallen into the 55-60F range and rainfall or overhead irrigation is expected after a KERB application. KERB must be applied before soils freeze-up. KERB has postemergence activity on bluegrass, chickweed, and Italian ryegrass, but most activity provided after application is residual. Use the higher rate range for larger weeds. Do not apply more than 4 lb KERB per acre per year. Do not feed or harvest for forage or dehydration within 120 days of the KERB application. Rainfast interval = None.</p>					

Weed Response¹ to Herbicides for Weed Management in Forage Legumes

	Lifecycle	PPI		PRE					POST								
		Balan	Eptam	Chateau	Prowl H2O	Sollicam	Treflan	Velpar	2,4-DB	Kerb	Glyphosate	Metribuzin	Paraquat	Poast	Pursuit	Raptor	Select
alligatorweed	A	---	---	---	P	---	P	---	---	---	GE	---	G	P	---	---	P
amaranth, spiny	A	GE	---	GE	FG	GE	G	---	FG	P	P	G	E	P	FG	F	P
apple, tropical soda	P	P	---	---	P	---	P	P	P	P	P	P	P	P	---	---	P
bahiagrass	P	P	P	P	P	G*	P	P	P	P	P	P	FG	G	P	P	GE
barley, little	A	---	---	---	P	GE	P	F	P	GE	E	---	GE	G	---	---	G
bedstraw, smooth	A	P	---	---	F	---	F	P	P	---	G	---	G	P	GE	GE	P
Bermudagrass	P	P	P	P	P	P	P	F	P	P	FG	P	F	E	P	P	G
blackberry/dewberry	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
broomsedge	P	P	P	P	P	P	P	P	P	P	G	P	FG	P	P	P	P
boneset, lateflower	P	P	P	P	---	---	---	---	P	---	---	P	G	P	---	---	P
bullrush	P	P	P	P	P	P	P	P	P	---	P	P	P	P	P	P	P
buttercup	A	---	---	---	P	---	P	P	P	---	---	---	FG	P	---	---	P
carrot, wild	B	P	---	---	P	---	P	---	---	---	---	---	FG	P	---	---	P
cheat	A	---	---	F	G	GE	G	P	P	---	E	---	E	G	---	---	GE
chickweed, common	A	GE	GE	GE	F	GE	F	E	---	GE	GE	---	G	P	GE	F	P
cocklebur, common	A	P	P	P	P	F	P	P	GE	---	E	F	E	P	GE	GE	P
crabgrass	A	GE	GE	F	GE	GE	GE	P	P	GE	E	G	E	E	FG	G	E
croton, woolly	A	---	---	---	P	---	P	---	---	---	G	---	P	P	---	---	P
cudweed	A	---	---	---	P	G	P	---	---	---	G	---	P	P	---	---	P
dallisgrass	P	P	P	P	P	P	P	P	P	P	FG	P	GE	FG	P	P	G
dandelion	P	P	P	P	P	P	P	P	FG	P	G	---	P	P	P	P	P
dock, curly	P	P	P	P	P	P	P	P	G	P	FG	---	P	P	P	P	P
dodder	A	P	P	P	P	P	P	---	---	P	---	---	P	P	F	P	P
dogbane, hemp	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P
dogfennel	P	P	P	P	P	G	P	P	---	P	F	P	P	P	P	P	P
eveningprimrose, cutleaf	A	---	---	---	P	---	P	---	---	---	F	---	F	P	P	P	P
falsedandelion, Carolina	B	---	---	---	P	---	P	---	---	---	G	---	P	P	P	P	P
foxtail, knotroot	P	P	P	P	P	F	P	P	P	P	F	P	FG	FG	P	P	FG
foxtail, yellow	A	GE	GE	F	F	GE	F	P	P	P	E	F	G	GE	G	G	E
garlic, wild	P	P	---	---	P	---	P	P	F	---	F	P	P	P	P	P	P
geranium, Carolina	A	---	---	---	P	GE	P	P	---	---	G	---	P	P	---	---	P
goldenrod	P	P	P	P	P	FG	P	P	P	G	F	P	P	P	P	P	P
goosegrass	A	---	GE	F	G	GE	G	P	P	P	E	G	E	GE	---	---	E
greenbriar (smilax)	P	P	P	P	P	---	P	P	P	P	P	P	P	P	P	P	P
henbit	A	---	GE	GE	FG	F	FG	F	F	F	GE	G	F	P	GE	FG	P
honeysuckle	P	P	P	P	P	P	P	P	P	E	P	P	P	P	P	P	P
horsenettle	P	P	P	P	P	P	P	P	P	PF	P	P	P	P	P	P	P
horseweed	A	---	---	GE	P	F	P	P	F	G	GE	P	G	P	---	---	P

¹Key to Response Ratings: E = excellent control, 90% or better; G=good control, 80-90%; F=fair control, 70-80%; P=poor control, less than 70%; ---=Insufficient data; ²Abbreviations: A = annual; B = Biennial; P = Perennial; *Seedling only

Weed Response¹ to Herbicides for Weed Management in Forage Legumes (cont)

	Lifecycle	PPI		PRE					POST								
		Balan	Eptam	Chateau	Prowl H2O	Solicam	Treflan	Velpar	2,4-DB	Kerb	Glyphosate	Metribuzin	Paraquat	Poast	Pursuit	Raptor	Select
Johnsongrass	P	P	P	P	F	F	FG	P	P	P	E	P	F	GE	F*	F*	E
kudzu	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P
lespedeza, sericea	P	P	P	P	P	P	P	P	F	P	F	P	P	P	P	P	P
lettuce, prickly	B	---	---	---	P	---	P	P	G	P	GE	---	FG	P	---	---	P
mint, perilla	A	P	P	P	P	---	P	P	G	P	GE	---	---	P	---	---	P
mustard, wild	A	---	---	G	P	GE	P	GE	G	GE	G	GE	F	P	G	GE	P
nutsedge	P	P	GE	P	P	F	P	P	P	P	F	F	FG	P	F	F	P
orange, trifoliate	P	P	P	P	---	P	---	P	P	P	F	P	F	P	P	P	P
palmetto	P	P	P	P	P	P	P	P	P	P	F	P	P	P	P	P	P
panicum, Texas	A	GE	GE	F	FG	GE	G	P	P	P	E	F	GE	GE	P	P	E
passionflower, maypop	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
pear, prickly	P	P	P	P	P	P	P	P	P	P	P	P	PF	P	P	P	P
pepperweed, Virginia	A	---	---	---	FG	GE	FG	P	---	---	E	---	---	P	G	P	P
persimmon	P	P	P	---	P	P	P	P	P	---	F	P	---	P	P	P	P
pigweeds	A	GE	---	GE	FG	GE	G	GE	G	---	E	FG	E	P	FG	FG	P
plantains	P	---	P	P	P	P	P	P	F	P	G	P	---	P	P	P	P
pokeweed, common	P	P	P	P	P	P	P	P	P	P	F	P	PF	P	P	P	P
radish, wild	A	---	---	GE	P	GE	P	GE	G	GE	FG	GE	FG	P	F	GE	P
ragweed, common	A	P	---	GE	P	F	P	P	G	---	E	F	FG	P	G	F	P
rescuegrass	A	---	---	---	---	---	---	P	P	P	E	P	G	G	P	P	G
rose, Cherokee	P	P	P	P	P	P	P	P	P	P	F	P	---	P	P	P	P
ryegrass, annual	A	GE	GE	F	G	GE	GE	P	P	GE	E	F	GE	GE	P	G	E
sandbur	A	GE	GE	F	G	GE	GE	P	P	P	E	F	GE	G	P	P	E
shepherdspurse	A	---	---	GE	F	GE	FG	GE	---	GE	E	GE	G	P	G	F	P
sicklepod	A	---	GE	---	P	F	P	---	F	---	E	G	G	P	---	---	P
sida, arrowleaf	A	---	G	---	P	G	P	P	F	---	FG	---	P	P	---	---	P
sida, prickly	A	---	G	---	P	GE	P	P	G	---	G	---	P	P	---	---	P
smartweed	A	---	---	GE	P	F	P	---	GE	G	E	GE	G	P	G	GE	P
smutgrass	P	P	P	P	P	F	P	P	P	P	FG	P	G	G	P	P	GE
sneezeweed, bitter	P	P	P	P	P	---	P	P	P	P	G	---	GE	P	---	---	P
sorrel, red	P	P	P	P	P	P	P	P	F	G*	FG	P	FG	P	---	---	P
spurge, nodding	A	---	---	---	P	F	P	P	FG	---	E	G	FG	P	FG	F	P
thistles	B	P	---	---	P	---	P	P	FG	---	FG	---	G	P	---	---	P
torpedograss	P	P	P	P	P	FG	P	P	P	P	FG	P	G	FG	P	P	G
trumpetcreeper	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
vaseygrass	P	P	P	P	P	F	P	P	P	P	FG	P	FG	G	P	P	GE
vervain, blue	P	P	P	---	P	---	P	---	F	---	FG	P	---	P	P	P	P

¹Key to Response Ratings: E = excellent control, 90% or better; G=good control, 80-90%; F=fair control, 70-80%; P=poor control, less than 70%; ---=Insufficient data; ²Abbreviations: A = annual; B = Biennial; P = Perennial; *Seedling only

WEED CONTROL IN GRASS FORAGES

Mike Marshall, Extension Weed Specialist

Postemergence Herbicides for Weed Management in Newly Sprigged Bermudagrass

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>diuron</i> Direx 4L Diuron 4L	0.8-2.4 qt	0.8-2.4 lb	7	70 days	12 hours
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Comments: Apply DIREX immediately after sprigging to control of annual broadleaves and grasses (up to 4" in height). Add a surfactant at 1 pt per 100 gallons of spray solution. Bermudagrass sprigs should be planted 2 inches deep to minimize chance of injury. Emerged bermudagrass at the time of treatment may be temporarily injured. DIREX is not labeled for use in established bermudagrass hayfields and pastures.

<i>picloram</i> +		0.22-0.9 lb	4	0 days	12 hours
<i>fluroxypyr</i> Surmount 2.15SL	1.5-6.0 pt	0.18-0.72 lb	4		

Comments: SURMOUNT is a RESTRICTED USE PESTICIDE. *Do not use SURMOUNT in areas of the state where cotton, tobacco, or other sensitive broadleaf crops are grown.* Apply at 1.5 pt/A to sprigged bermudagrass once runners (stolons) have reached 6 inches in length and growing conditions are favorable. Do not apply more than 3 qt/A per year. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

<i>sulfosulfuron</i> Outrider 75DF	1.33 oz	0.062 lb	2	14 days	12 hours
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Comments: Apply OUTRIDER at 1.33 oz/A to control johnsongrass, yellow and purple nutsedge, and other weeds in newly sprigged bermudagrass hayfields and pastures 4 weeks after emergence of sprigged areas. For best results, do not graze or mow pasture/hayfield 2 weeks before or 2 weeks after application. Addition of NIS at 1 qt/100 gal is required. A follow-up application of OUTRIDER can be made when sufficient weed regrowth is observed, but no sooner than 4 weeks after the previous application.

<i>2,4-D amine (various)</i>	1.0-2.0 qt	1.0-2.0 lb ae	4	7 days	48 hours
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Comments: Apply 2,4-D to emerged broadleaf weeds 3-4 inches tall. Apply 1 lb ae/A for susceptible annual and biennial broadleaves and 2 lb ae/A for difficult-to-control broadleaf biennials and perennials. Apply low volatile esters from October through March. Use only non-volatile AMINE formulations from late March through September. Do not apply more than 2.0 qt per acre per season. Do not make more than 2 applications per year. Minimum interval between sequential applications is 30 days. For best results, apply to thistles when they are in the rosette stage of growth (less than 3 inches). *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

<i>2,4-D choline</i> +		0.375 lb	4	30 days	48 hours
<i>picloram</i> Graslan 3.81L	1.0 pt	0.10 lb	4		

Comments: GRASLAN is a RESTRICTED USE PESTICIDE. Apply GRASLAN at 1.0 pt/A to sprigged bermudagrass once runners (stolons) have reached 6 inches in length and growing conditions are favorable. *GRASLAN should not be used in areas of the state where cotton, tobacco, or other sensitive broadleaf crops are grown. Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Herbicides for Weed Management in Dormant Established Grass Forages

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>indaziflam</i> Rezilon 1.67CS	3.0-5.0 fl oz	0.04-0.065 lb	29	**	12 hours
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Comments: Apply REZILON in late January to early February to dormant bermudagrass, bahiagrass, and other warm season perennial grasses to control summer annual weeds. Tank mix with GLYPHOSATE or PARAQUAT to control emerged weeds. Provides residual control of crabgrass, sandburs, pigweed, annual bluegrass, crowfootgrass, signalgrass, wild mustard, and cudweed. For extended residual control, apply REZILON at 3.0 fl oz/A during the mid-to late-season (July-September). **If REZILON is applied at rates greater than 3.0 fl oz/A, hay may not be harvested until 40 days after application (0 days for 3.0 fl oz/A rate). Do not exceed 6.0 fl oz REZILON/A per calendar year. Allow a minimum of 60 days between applications. There are no grazing restrictions following REZILON application.

<i>glyphosate</i> (various)	8-11 oz	0.28-0.38 lb ae	9	21 days	12 hours
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Comments: Apply in early- to late-winter months to early spring (prior to green-up) in bermudagrass pastures to control winter weeds. Apply before bermudagrass exhibits new growth in the spring. Some stunting will occur when applications are made when crop is not dormant. Only one application of GLYPHOSATE is permitted per year. If a spring application prior to growth initiation was made, then an application following the first cutting may not be made in the same year.

<i>paraquat</i> 2S	1.0-2.0 pt	0.25-0.50 lb	22	40 days	12 hours
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<i>paraquat</i> 3S	0.7-1.3 pt	0.26-0.49 lb			
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Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Apply in a minimum of 10 gallons of water in late winter or early spring (February or March) before bermudagrass breaks dormancy and begins spring green-up. Add 1 pt NIS per 100 gal. of spray mix. Do not mow for hay until 40 days after treatment. Do not make more than 3 applications per year.

<i>pendimethalin</i> Prowl H ₂ O 3.8CS	1.1-4.2 qt	1.1-4.0 lb	3	0 days	24 hours
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Comments: Apply PROWL H₂O in late-February to mid-March in early spring to dormant bermudagrass, bahiagrass, and switchgrass pastures. Apply before any new growth appears in the spring. Provides residual control of crabgrass, sandburs, and pigweed. PROWL H₂O may be applied in two split applications with the first half at the onset of winter dormancy and the remainder in early spring before green-up. Do not apply more than 4.2 qt/A of PROWL H₂O in one cropping season.

Postemergence Herbicides for Weed Management in Grass Forages

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>aminopyralid</i>		0.047-0.109 lb	4	14 days	48 hours
Milestone	3.0-7.0 oz				

Comments: Controls annual and perennial broadleaf weeds, including invasive and noxious weeds. Add a nonionic surfactant at 1 qt/100 gal. Do not plant a broadleaf crop until conducting a field bioassay. Do not apply more than 7 fl oz/acre of MILESTONE per year. MILESTONE will kill legume crops such as clovers or alfalfa. Do not use MILESTONE on grasses grown for seed production. Hay from grass treated with MILESTONE within the preceding 18 months can only be used on the farm or ranch where the product is applied*. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Aminopyralid Hay/Manure Restrictions: Do not use grasses treated with AMINOPYRALID in the preceding 18 months for hay intended for export outside the United States. Hay from areas treated with AMINOPYRALID in the preceding 18 months can not be distributed or sold from the farm or ranch where harvested. Hay from areas treated with AMINOPYRALID can not be used for silage, baylage, or green chop. Do not use hay or straw from areas treated with AMINOPYRALID within the preceding 18 months or manure from animals feeding on hay treated with AMINOPYRALID in compost. Do not use grasses treated with AMINOPYRALID in the preceding 18 months for seed production.

<i>aminopyralid</i>		0.06-0.11 lb	4	7 days	48 hours
+					
2,4-D		0.50-0.87 lb	4		
GrazonNext HL 3.74SL	1.2-2.1 pt				
ForeFront HL 3.74SL					

Comments: GRAZONNEXT/FOREFRONT controls annual and perennial broadleaf weeds. Add a NIS at 0.25% v/v. Do not plant a broadleaf crop until conducting a field bioassay. GRAZONNEXT/FOREFRONT will kill legume crops such as clovers or alfalfa. Do not apply more than 2.1 pt/A per season. Do not make more than 2 applications per year. Do not apply within 30 days of previous application. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Aminopyralid Hay/Manure Restrictions: Do not use grasses treated with AMINOPYRALID in the preceding 18-months for hay intended for export outside the United States. Hay from areas treated with AMINOPYRALID in the preceding 18 months cannot be distributed or made available for sale off the farm or ranch where harvested. Do not use treated hay or straw from or manure from animals feeding on treated hay in compost. Do not use the grasses treated with AMINOPYRALID in the preceding 18 months for seed production.

<i>aminopyralid</i>		0.063-0.104 lb	4	14 days	48 hours
+		+			
<i>florpyrauxifen</i>		0.006-0.010 lb	4		
DuraCor 0.73SL	12-20 fl oz				

Comments: DURACOR controls many annual and perennial broadleaf weeds, including invasive, noxious, and poisonous weeds. Add a nonionic surfactant at 1 qt/100 gal. Do not plant a broadleaf crop until conducting a field bioassay. Do not apply more than 20 fl oz/acre of DURACOR per year. DURACOR will kill legume crops such as clovers or alfalfa. Do not make more than 2 applications per year. Do not apply within 30 days of the previous application. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Aminopyralid Hay/Manure Restrictions: Do not use grasses treated with AMINOPYRALID in the preceding 18-months for hay intended for export outside the United States. Hay from areas treated with AMINOPYRALID in the preceding 18 months cannot be distributed or made available for sale off the farm or ranch where harvested. Do not use treated hay or straw from or manure from animals feeding on treated hay in compost. Do not use the grasses treated with AMINOPYRALID in the preceding 18 months for seed production.

Postemergence Herbicides for Weed Management in Grass Forages (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>aminopyralid</i> +		0.014-0.020 lb	4	14 days	48 hours
<i>metsulfuron</i> Chaparral 0.71DF	2.0-3.0 oz	0.002-0.003 lb	2		

Comments: Apply CHAPARRAL at 2.0 oz/A to control most broadleaf species common in bermudagrass pastures and hayfields. Add a NIS at 1 qt per 100 gallons of spray solution *or* COC at 1 gallon per 100 gal spray solution *plus* ammonium nitrogen fertilizer at 2 qt/A or spray grade ammonium sulfate at 2 lb/A. Do not plant a broadleaf crop until conducting a field bioassay. CHAPARRAL will kill legume crops such as clovers or alfalfa. Do not exceed 3.3 oz/A per year. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Aminopyralid Hay/Manure Restrictions: Do not use grasses treated with AMINOPYRALID in the preceding 18 months for hay intended for export outside of United States. Hay from areas treated with AMINOPYRALID in the preceding 18 months CANNOT be distributed or made available for sale off farm or ranch where harvested. Hay from areas treated with AMINOPYRALID in the preceding 18-months CAN NOT be used for silage, baylage, haylage, and green chop. Do not move hay made from grass treated with AMINOPYRALID within the preceding 18-months off farm. Do not use hay or straw from areas treated with AMINOPYRALID within the preceding 18-months or manure from animals feeding on hay treated with AMINOPYRALID in compost. Do not use grasses treated with AMINOPYRALID in the preceding 18 months for seed production.

<i>carfentrazone</i> Aim 2 EC	0.5-1.5 fl oz	0.008-0.024 lb	14	0 days	12 hours
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Comments: Apply AIM in a minimum of 25 gallons of finished spray solution with ground equipment to control broadleaf weeds up to 4 inches tall including bitter sneezeweed, cocklebur, hophornbeam copperleaf, woolly croton, and jimsonweed. AIM, at the higher rate, will provide suppression of buttercup, horsenettle, and dogfennel. Add a nonionic surfactant at 1 qt/100 gals plus ammonium sulfate at 2.5 lbs/A. May be tank mixed with other herbicides labeled for pasture use. Do not make sequential applications less than 7 days apart. Do not apply more than 5.9 fl oz/A per season. Do not make more than 3 applications per season.

<i>chlorsulfuron</i> Telar XP 75DF	0.25-1.0 oz	0.012-0.047 lb	2	0 days	4 hours
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Comments: TELAR XP is effective on dewberry, blackberry, pigweeds, and radish. Do not apply more than 0.5 oz/A on Tall Fescue, Bluestems, or Switchgrass. Fescues may exhibit temporary stunting or yellowing after TELAR application. Do not apply TELAR over ryegrass (annual or Italian). Do not apply more than 1.3 oz/acre/year of TELAR XP. No grazing or haying restrictions following TELAR XP application.

<i>clopyralid</i> Stinger 3S	0.5-1.33 pt	0.19-0.50 lb	4	0 days	12 hours
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Comments: STINGER controls numerous annual, biennial, and perennial broadleaves. Consult label for specific weed spectrum. Legumes including alfalfa and clovers will be severely injured or killed by STINGER. Do not apply to newly seeded pasture grasses until they are well established as evidenced by tillering and establishment of secondary root system. Do not use hay or straw cut from treated areas for composting or mulching on broadleaf crops. Do not apply more than 1.33 pt/A per growing season. *Do not make applications when circumstances favor movement from treatment site.*

<i>dicamba</i> Banvel 4SL	1.0-3.0 pt	0.5-1.5 lb	4	30 days	24 hours
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Comments: If thistles are present, apply while they are in the rosette stage of growth. This treatment may severely injure or kill clovers, alfalfa, and other legumes. *Do not spray when circumstances favor vapor and/or particle drift from application site to sensitive crops.*

Postemergence Herbicides for Weed Management in Grass Forages (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>glyphosate</i>	10 oz	0.35 lb ae	9	21 days	4 hours
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Comments: Apply GLYPHOSATE after the first bermudagrass cutting when bermudagrass has not yet initiated regrowth. Controls crabgrass, field sandbur, seedling johnsongrass and most annual grasses. Applications made after regrowth has begun will injure bermudagrass. Only one application of GLYPHOSATE is permitted per year. If a spring application prior to growth initiation and application following the first cutting may not be made in the same year.

<i>halosulfuron-methyl</i>		0.031-0.62 lb	2	37 days	12 hours
Sandea 75DF	0.67-1.33 oz				

Comments: Apply SANDEA to actively growing broadleaf weeds 1-3 inches tall. For perennial nutsedge (yellow and purple), apply SANDEA at the 3 to 5 leaf growth stage. Temporary crop stature reduction may occur after application of SANDEA if millet is under stress. Apply SANDEA in a minimum of 10 gal of water per acre. Add a non-ionic surfactant (NIS) at 1-2 qt per 100 gal of spray solution. Avoid applications when weeds are under drought or heat stress. Do not make more than 2 applications or 1.33 oz/A of SANDEA in a 12-month period. Do not harvest green or dry forage within 37-days application. Animals are permitted to graze fields immediately following applications of SANDEA. **Rainfast interval 4 hours.**

<i>halosulfuron-methyl</i>		0.031-0.077 lb	2	37 days	24 hours
+		+			
<i>dicamba</i>		0.14-0.28 lb	4		
Yukon 67.5WDG	4.0-8.0 oz				

Comments: Apply YUKON to actively growing broadleaf weeds 1-3 inches tall. For perennial nutsedge (yellow and purple), apply YUKON at the 3 to 5 leaf growth stage. Use higher rate for larger weeds and/or higher field infestations. Apply YUKON in a minimum of 10 gal of water per acre. Add a non-ionic surfactant (NIS) at 1-2 qt per 100 gal of spray solution. Crop oil concentrate at 1 gal per 100 gal of spray solution may be substituted for NIS. Nitrogen fertilizer (AMS or UAN) at 2-4 lb per acre may improve YUKON efficacy on difficult to control weeds. Do not apply YUKON using nitrogen fertilizer as the total carrier or severe crop injury may occur. To maximize control of perennial nutsedge (purple and yellow), two applications may be required to areas in the treated field where nutsedge has emerged or regrown since the last application. Avoid applications when weeds are under drought or heat stress. Do not make more than 2 applications per 12-month period. Do not harvest green or dry forage within 37 days of application. Dairy animals are permitted to graze fields immediately following applications of YUKON. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

<i>hexazinone</i>		0.68-1.13 lb	5	60 days	48 hours
Velpar 2SL	2.75-4.5 pt				
Velpar 75DF	0.9-1.5 lb				

Comments: Controls smutgrass in established bermudagrass and bahiagrass pastures and hayfields. Use low rate on coarse sandy soils, and high rate on fine-textured soils. Bermudagrass injury from VELPAR will range from moderate to severe and may eliminate the first cutting of hay. Bahiagrass and bermudagrass will recover from temporary burn and yellowing within two to four weeks of application. Use only on bermudagrass and bahiagrass that have been established one year or more. Do not apply VELPAR near oak trees.

Postemergence Herbicides for Weed Management in Grass Forages (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>indaziflam</i> Rezilon 1.67CS	3.0-5.0 fl oz	0.04-0.065 lb	29	**	12 hours
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Comments: Apply REZILON immediately after harvest of bermudagrass, bahiagrass, or other warm season perennial grasses to control summer annual weeds that have not germinated. Application should be within a few days of harvest to minimize canopy interference and maximize soil coverage. Tank mix with GLYPHOSATE or PARAQUAT to control emerged weeds. Provides residual control of crabgrass, sandburs, pigweed, annual bluegrass, crowfootgrass, signalgrass, wild mustard, and cudweed. For, extended residual control, apply REZILON at 3.0 fl oz/A at the following timings during the calendar year 1) mid- to late-season (July-September) for winter annual weed control and 2) early February for summer annual weed control. **If REZILON is applied at rates greater than 3.0 fl oz/A, hay may not be harvested until 40 days after application (0 day haying restrictions for the 3.0 fl oz/A or less product rate). There are no grazing restrictions for REZILON. Do not exceed 6.0 fl oz REZILON/A per calendar year. Allow a minimum of 60 days between applications.

<i>imazapic</i> Impose 2SL	4-12 oz	0.063-0.188 lb	2	0 days	12 hours
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Comments: Apply 4-6 oz/A for summer annual broadleaf and grass weeds and 6-12 oz/A for perennial grass weeds. Bermudagrass growth may be suppressed for 30-45 days after application. Do not apply to drought stressed bermudagrass. Add a NIS (1 qt/100 gal) or MSO at 1.5-2.0 pt/A to the spray mix. Do not apply during transition from dormancy to full green-up. Do not use on newly sprigged or seeded bermudagrass. Apply IMPOSE or PANORAMIC in 10-20 gal/A nitrogen fertilizer (28-32% N) as a spray carrier will shorten the recovery time.

<i>metsulfuron</i> Metsulfuron 60DF	0.1-0.4 oz	0.004-0.015 lb	2	0 days	4 hours
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Comments: Apply 0.1-0.4 oz/A for control of summer annual and perennial broadleaf weeds. Add a nonionic surfactant at 1 qt per 100 gal of spray solution. METSULFURON may be tank mixed with 2,4-D (ester formulations preferred), BANVEL, GRAZON P+D, REMEDY, TORDON 22K, or WEEDMASTER.

<i>metsulfuron</i> Cimarron MAX Part A	0.25-1.0 oz	0.009-0.037 lb	2	37 days	48 hours
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<i>dicamba</i> +		0.25-0.5 lb	4		
2,4-D Cimarron MAX Part B	1.0-4.0 pt	0.72-1.44 lb	4		

Comments: CIMARRON MAX is a 2 part (Part A – metsulfuron; Part B – dicamba + 2,4-D) product used for annual and perennial broadleaf weed control in bermudagrass pastures. Desirable broadleaf forage plants, such as clover or alfalfa, may be severely injured or killed. Apply with NIS (1 qt/100 gal) or COC (1 gal/100 gal) plus nitrogen fertilizer at 2 qt/A (UAN) or 2 lb/A (AMS). Do not make applications when circumstances favor movement from treatment site to sensitive areas.

<i>metsulfuron</i> +		0.004-0.038 lb	2	0 days	4 hours
<i>chlorsulfuron</i> Cimarron Plus 63DF Chisum 63DF	0.125-1.25 oz	0.001-0.011 lb	2		

Comments: Apply CIMARRON PLUS to established bermudagrass for the control of ‘Pensacola’ bahiagrass and certain broadleaf weeds. Add 1.0 pt to 1.0 qt nonionic surfactant per 100 gal. of spray mix. Not effective for the control of ‘Common’ or ‘Argentine’ bahiagrass. Desirable broadleaf forage plants, such as clover or alfalfa, may be severely injured or killed.

Postemergence Herbicides for Weed Management in Grass Forages (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>nicosulfuron</i>		0.035-0.053 lb	2	0 days	4 hours
+		+			
<i>metsulfuron</i>		0.009-0.014 lb	2		
Pastora 71.2DF	1.0-1.5 oz				

Comments: Apply PASTORA to *bermudagrass hayfields and pastures* anytime during the growing season for control of sandburs, crabgrass, blackberry, vaseygrass, and Pensacola bahiagrass. Allow at least 16 days between applications of PASTORA. For control of vaseygrass, apply PASTORA at 1.0-1.5 oz/A 7 to 14 days after cutting bermudagrass for hay when vaseygrass has regrown 2-4 inches above the bermudagrass. A repeat application may be necessary for adequate level of control. Do not apply more than 2.5 oz/A of PASTORA per year. Add non-ionic surfactant at 1 qt/100 gal of spray solution plus nitrogen fertilizer at 2 qt/A or a spray grade AMS at 4 lb/A. There is no grazing or haying restrictions after using PASTORA.

<i>nicosulfuron</i>		0.035-0.053 lb	2	0 days	4 hours
+		+			
<i>metsulfuron</i>		0.009-0.014 lb	2		
Pastora 71.2DF	1.0-1.5 oz				
+					
<i>glyphosate*</i>	4.0-6.0 fl oz	0.14-0.21 lb ae	9		

Comments: For improved control of crabgrass, sandburs, foxtails, rescuegrass, little barley, and ryegrass, tank mix PASTORA with GLYPHOSATE and apply to *bermudagrass hayfields and pastures*. A repeat application may be necessary for adequate level of control. Allow at least 14 days between applications of PASTORA plus GLYPHOSATE. Do not apply more than 2.5 oz/A of PASTORA per year. Add non-ionic surfactant at 1 qt/100 gal of spray solution. Applications of PASTORA plus GLYPHOSATE may result in temporary stunting or yellowing of bermudagrass.

<i>pendimethalin</i>		1.0-4.0 lb	3	0 days	24 hours
Prowl H2O 3.8CS	1.1-4.2 qt				

Cool-Season Forage Grasses Comments: Apply PROWL H₂O before target weed germination during the fall after the last cutting, in winter, in spring, or in-season between cuttings. PROWL H₂O will not control emerged weeds. Do not apply PROWL H₂O to mixed stands of cool-season forage grasses with other forage legumes besides alfalfa. Provides residual control of crabgrass, sandburs, and pigweed. Do not apply more than 4.2 qt/A of PROWL H₂O in a single cropping season. Do not apply Prowl H₂O to areas where standing water is present in the field. There is no preharvest interval following a PROWL H₂O application and livestock grazing or forage harvest.

Warm-Season Forage Grasses Comments: Apply PROWL H₂O before target weed germination during the fall after the last cutting, during dormancy period or in early spring before greenup, or in-season between cuttings. PROWL H₂O will not control emerged weeds. Do not apply PROWL H₂O to bermudagrass and bahiagrass after greenup in the spring before the first cutting. Provides residual control of crabgrass, sandburs, and pigweed. For residual control of sandburs through the growing season, consider applying PROWL H₂O in a split application with the first half (1-2 qt) at the end of the dormant season and the remainder (1-2 qt) in mid-summer following a cutting. Do not apply more than 4.2 qt/A of PROWL H₂O in a single cropping season. Do not apply Prowl H₂O to areas where standing water is present in the field. There is no preharvest interval following a PROWL H₂O application and livestock grazing or forage harvest.

Postemergence Herbicides for Weed Management in Grass Forages (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>picloram</i> +		0.22-0.9 lb	4	**	12 hours
<i>fluroxypyr</i> Surmount 2.15SL	1.5-6.0 pt	0.18-0.72 lb	4		

Comments: SURMOUNT is a RESTRICTED USE PESTICIDE. Do not use SURMOUNT in areas of the state where cotton, tobacco, or other sensitive broadleaf crops are grown. Controls a wide range of herbaceous and woody broadleaf plants. Use 1.5 to 2.0 pt/A for herbaceous broadleaf weeds. Use 3.0 to 6.0 pt/A for woody brush and trees. Do not apply more than 3 qt/A per season of SURMOUNT. Do not transfer livestock from treated grazing areas onto broadleaf crop areas without first allowing 7 days of grazing of untreated grass pasture. Do not move treated soil or use treated soil for growing other plants until soil residues of picloram are no longer detectable by chemical assay. Do not use grass from treated areas or manure from animals being fed treated forage for composting or mulching of desirable, susceptible broadleaf plants. Do not make applications when circumstances favor movement from treatment site. **14 days for lactating dairy animals; 0 days for all other animal types.

<i>quinclorac</i> Facet 1.5SL	22-64 fl oz	0.26-0.75 lb ae	4,26	7 days (hay) 0 days (grazing)	12 hours
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Comments: Apply FACET to established grass pastures for control of small actively growing large crabgrass, broadleaf signalgrass, barnyardgrass, annual morningglory, eclipta, and hemp sesbania. Activity on perennial grasses (i.e., vaseygrass and knotroot foxtail) is enhanced at rate above 32 fl oz/A. Add 2 pts of crop oil concentrate (COC) or 1 to 2 pts of methylated seed oil (MSO) per acre for enhanced herbicide activity on weeds. A nitrogen fertilizer source (ammonium sulfate or urea ammonium sulfate) can also improve weed control. If the tank mix partner with FACET restricts the use of oil additives, a non-ionic (NIS) surfactant may be substituted at 1 qt per 100 gal of spray solution plus a nitrogen fertilizer source (AMS or UAN) at 8.5 lb per 100 gal of spray solution. The use of NIS may result in reduced weed control. Do not apply in areas where surface water is present or to irrigation ditches or areas that act as a channel for water entering a crop field.

<i>sulfosulfuron</i> Outrider 75DF	1.33-2.0 oz	0.047-0.094 lb	2	14 days	12 hours
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Comments: Apply OUTRIDER at 1.33 oz/A from early spring through fall to control johnsongrass (minimum of 18-24 inches tall), yellow and purple nutsedge, and other weeds in bahiagrass and bermudagrass hayfields and pastures. A follow-up application can be made 40 days after last application. For control of large weeds or when weed growth is heavy or dense, a single application of 2.0 oz/A is permitted. For best results, do not graze or cut pasture/hayfield 2 weeks before or 2 weeks after application. Addition of NIS at 1 qt/100 gal is required. No crop, except wheat, may be planted into a treated pasture within 12 months of application.

<i>triclopyr</i> Garlon 3A	2.0-5.0 pt	0.75-1.88 lb ae	4	14 days	48 hours
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Comments: Apply GARLON 3A to established grass pastures for control of annual and perennial broadleaf weeds and woody brush/trees. Desirable forage broadleaf plants, such as clover or alfalfa, may be killed if sprayed. Applications at air temperatures >85°F may cause moderate to severe bermudagrass injury for two to three weeks. Do not apply more than 2.0 lb ae/A of GARLON 3A per growing season. Do not make applications when circumstances favor movement from treatment site to sensitive areas.

Postemergence Herbicides for Weed Management in Grass Forages (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>triclopyr</i> Remedy Ultra 4S	1.0-2.0 pt	0.5-1.0 lb	4	14 days	**
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Comments: Apply REMEDY ULTRA to established grass pastures for control of broadleaf weeds and woody brush. REMEDY ULTRA may be tank-mixed with 2,4-D for broader spectrum weed control and control of sensitive herbaceous species. Desirable forage broadleaf plants such as clover or alfalfa may be killed if sprayed. Applications at air temperatures >85°F may cause moderate to severe bermudagrass injury for two to three weeks. Do not apply more than 0.5 gal/A of REMEDY ULTRA per growing season. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.* ****Do not enter or allow others to enter treated area until sprays have dried completely.**

<i>triclopyr</i> +		0.3-1.5 lb	4	14 days	12 hours
<i>fluroxypyr</i> PastureGard HL 4SL	1.5-8.0 pt	0.1-0.5 lb	4		

Comments: Controls a wide range of herbaceous and woody broadleaf plants. Use 1.5 to 3.0 pts./acre for herbaceous broadleaf weeds. Use 2.0 to 8.0 pts./acre for woody brush and trees. Do not graze lactating dairy animals on treated areas during the same growing season following application. Withdraw meat animals from treated forage at least 3 days before slaughter. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

2,4-D +		0.72-1.44 lb	4	37 days	48 hours
<i>dicamba</i> Weedmaster 3.87SL	1.0-4.0 pt	0.25-0.5 lb	4		

Comments: For control of a broad spectrum of weeds, apply in late spring or early summer to annual or perennial broadleaf weeds before flowering. If thistles are present, apply while they are in the rosette stage of growth. For horsenettle, use 4.0 pt/A rate. WEEDMASTER may severely injure or kill clovers or alfalfa. *Do not make applications when circumstances favor movement from treatment site.*

2,4-D +		0.5-2.0 lb	4	14 days	**
<i>triclopyr</i> Crossbow 3SL	1.0-4.0 qt	0.25-1.0 lb	4		

Comments: Apply CROSSBOW to control broadleaf weeds and woody plants. Desirable forage broadleaf plants such as clover or alfalfa may be killed if sprayed. For range and pasture sites, do not apply more than 1 gallon CROSSBOW per acre per season. Do not make more than 1 application per year in rangeland and pasture areas. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.* ****Do not enter or allow others to enter treated area until sprays have dried completely.**

2,4-D amine (various)	2.0-4.0 pt	1.0-2.0 lb ae	4	7 days	48 hours
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Comments: Apply 2,4-D to emerged broadleaf weeds 3-4 inches tall. Apply 1 lb ae/A for susceptible annual and biennial broadleaves and 2 lb ae/A for difficult-to-control broadleaf biennials and perennials. Apply low volatile esters from October through March. Use only non-volatile AMINE or ACID formulations from late March through September. Do not apply more than 2.0 qt per acre per season. Do not make more than 2 applications per year. Minimum interval between sequential applications is 30 days. If thistles are present, apply while they are in the rosette stage of growth. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Postemergence Herbicides for Weed Management in Grass Forages (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

2,4-D choline		0.95-1.9 lb ae	484	7 days	48 hours
Freelexx 3.8SL	2.0-4.0 pt				

Comments: Apply FREELEXX to established grass pastures for control of annual and perennial herbaceous broadleaf and woody brush/trees. For susceptible annual and biennial broadleaf weeds, do not apply more than 2 pints per acre of FREELEXX per acre per application. For more difficult to control biennials, perennials, and woody species, do not apply more than 4 pints per acre of FREELEXX per application. Do not use on newly seeded areas until grass is well established. Do not use from early boot to milk stage where grass seed productin is desired. For grazed areas, the maximum use rate if 4.21 pt of FREELEXX (2 lb ae) per acre per application. Do not apply more than two applications per season or more than 8.42 pt of FREELEXX (4 lb ae) per area per season. For spot treatments, mix 1.28 fl oz of FREELEXX per gallon of spray solution. The addition of a non-ionic surfactant is recommended for improved coverage when applying spot treatments.

2,4-D choline		0.38-1.0 lb	4	21 days	48 hours
+					
picloram		0.07-0.27 lb	4		
Graslan 3.81SL	0.67-2.67 pt				

Comments: GRASLAN is a RESTRICTED USE PESTICIDE. Apply GRASLAN at 2.67 pt/A or less to control broadleaf weeds permanent grass pastures that will be over-seeded with grasses (annual ryegrass, wheat, rye, oats, or tall fescue). Use higher rate for larger weeds and heavier infestations. Site should be left undisturbed for 21 days after application. Apply GRASLAN at 5.0 pt/A for control of prickly pear cactus, horsenettle, or other woody plants. For permanent pastures that have been over-seeded with ryegrass or small grains, do not apply GRASLAN in excess of 1.0 pt/A and delay application until seedling grasses are established at the tiller stage or later. Not recommended for use in rotational systems that utilize broadleaf crops or in temporary summer or winter grazing grass systems unless temporary grass is seeded into a permanent pasture. Do not apply more than 5 qt/A per year. Do not make more than 2 applications per year. Do not apply within 30 days of the previous application. Do not use hay or other plant materials from treated areas or manure from animals being fed treated forage or hay for composting or mulching desirable, susceptible broadleaf crops. *Do not make applications when circumstances favor movement from treatment site to sensitive areas.*

Spot Treatments for Weed Management in Grass Forages

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

imazapyr		0.03-0.75 lb	2	7 days	48 hours
Arsenal 2SL	2.0-48.0 fl oz				

Comments: Apply ARSENAL for control of undesirable broadleaves and grasses in permanent grass pastures using approved ground application methods (see label). Spot applications to grass pastures using ARSENAL cannot exceed 10% of the area to be grazed or cut for hay. Do not apply more than 48 fl oz of ARSENAL per acre per year.

tebuthiuron		2-4 lb	7	1 year (hay)	--
Spike 20P	10-20 lb (3/8-3/4 oz per 100 ft ²)				

Comments: Apply SPIKE for control of woody vegetation such as trees, shrubs, and vines in permanent grass pastures. Recommended time for a SPIKE application is during the dormant season prior to woody vegetation growth which minimizes the injury on desirable forage grasses. Spot applications to grass pastures using SPIKE cannot exceed 10% of the grazing or haying area.

Postemergence Herbicides for Weed Management in Temporary Grass Forages

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>atrazine</i> Atrazine 4L	1.0-2.0 qt	1.0-2.0 lb	5	45 days	12 hours
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Comments: Labeled for forage sorghum/sudangrass hybrids. Apply ATRAZINE before weeds exceed 1.5 inches in height and before forage sorghum is taller than 12 inches. Add COC at 1 gallon per acre to the spray mixture. Do not apply this mixture to forage sorghum grown on sands or loamy sands or injury may occur.

<i>bentazon</i> Basagran 4S	1.0-2.0 pt	1.0-2.0 lb	6	12 days	48 hours
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Comments: Labeled for forage sorghum. Treat broadleaves when small and actively growing. Adjust rate according to weed size indicated on the product label. Do not apply more than 2 pt/A per season in forage sorghum. Do not apply to forage sorghum that is heading or blooming. Tank mix partners include ATRAZINE, CLARITY, or MARKSMAN.

<i>dicamba</i> Banvel 4S	1.0 pt	0.5 lb	4	30 days	24 hours
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Comments: Labeled for forage sorghum. Treat broadleaves when small and actively growing (less than 4 inches in height). Do not apply more than 1.0 pt/A of BANVEL to reduce risk of crop injury. Do not make applications when circumstances favor movement from treatment site.

<i>fluoxypyr</i> Starane Ultra 2.8S	0.3-0.4 pt	0.105-0.14 lb	4	7 days	24 hours
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Comments: Labeled for forage sorghum/sudangrass hybrids. Treat broadleaves when small and actively growing. Adjust rate according to weed size indicated on the product label. Wait a minimum of 14 days between applications (2 permitted per season). Do not apply more than 0.7 pt/A per season in forage sorghum.

<i>halosulfuron-methyl</i> Sandeia 75DF	0.5-0.67 oz	0.023-0.031 lb	2	37 days	12 hours
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Comments: Labeled for proso millet. Apply SANDEA from the 2-leaf to layby stage (before grain head emergence) of proso millet to actively growing broadleaf weeds 1-3 inches tall. For perennial nutsedge (yellow and purple), apply SANDEA at the 3 to 5 leaf growth stage. Temporary crop stature reduction may occur after application of SANDEA if millet is under stress. Apply SANDEA in a minimum of 10 gal of water per acre. Add a non-ionic surfactant (NIS) at 1-2 qt per 100 gal of spray solution. Avoid applications when weeds are under drought or heat stress. Do not make more than 1 application of 0.67 oz/A in a 12-month period. Do not harvest green or dry forage within 37 days of application. Animals are permitted to graze fields immediately following applications of SANDEA. **Rainfast interval 4 hours.**

<i>halosulfuron-methyl</i> +		0.029-0.031 lb	2	37 days	24 hours
<i>dicamba</i> Yukon 67.5WSG	3.0-4.0 oz	0.10-0.14 lb	4		

Comments: Labeled for proso millet. Apply YUKON from the 3- to 5-leaf growth stage of proso millet to actively growing broadleaf weeds 1-3 inches tall. For perennial nutsedge (yellow and purple), apply YUKON at the 3 to 5 leaf growth stage. Temporary crop stature reduction may occur after application of YUKON if millet is under stress. Apply YUKON in a minimum of 10 gal of water per acre. Add a non-ionic surfactant (NIS) at 1-2 qt per 100 gal of spray solution. Crop oil concentrate at 1 gal per 100 gal of spray solution may be substituted for NIS. Nitrogen fertilizer (AMS or UAN) at 2-4 lb per acre may improve YUKON efficacy on difficult to control weeds. Do not apply YUKON using nitrogen fertilizer as the total carrier or severe crop injury may occur. Avoid applications when weeds are under drought or heat stress. Do not make more than 1 application per 12-month period. Do not harvest green or dry forage within 37 days of application. Animals are permitted to graze fields immediately following applications of YUKON. Do not make applications when circumstances favor movement from treatment site to sensitive areas.

Postemergence Herbicides for Weed Management in Temporary Grass Forages (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
pyrasulfotole +		0.031-0.039 lb	27	7 days	24 hours
bromoxynil Huskie 2.06EC	13-16 fl oz	0.18-0.22 lb	6		

Comments: HUSKIE is a RESTRICTED USE PESTICIDE. Labeled for forage sorghum. Apply to forage sorghum from 3-leaf growth stage up to 12 inches in height. Treat broadleaves when small and actively growing. Do not apply more than 16 fl oz/A per application. Do not apply more than 2 applications of HUSKIE with a season maximum of 32 fl oz/A. Wait a minimum of 11 days between HUSKIE applications. Do not use air induction or flood jet nozzles to apply HUSKIE. Unacceptable crop response may occur if HUSKIE is applied to acreage previously treated with any product containing mesotrione (i.e., LUMAX, LEXAR, CALLISTO). Do not apply HUSKIE in a tank mixture with LORSBAN.

2,4-D +		0.72 lb	4	37 days	48 hours
dicamba Weedmaster 3.87SL	1.0 pt	0.25 lb	4		

Comments: Labeled for forage sorghum. Apply WEEDMASTER to forage sorghum in the 3 to 5 leaf stage of growth (4 to 8 inches tall). For best results, apply when weeds are less than 3 inches tall. Applications during period of rapid growth may result in temporary leaning of plants or rolling of leaves. These effects are usually outgrown in 10 to 14 days. Do not use oils or other surfactants with postemergence applications of WEEDMASTER. Do not make more than 1 postemergence application per crop cycle. Tank mix partners include ATRAZINE, BASAGRAN, and BUCTRIL. Do not make applications when circumstances favor movement from treatment site to sensitive areas.

2,4-D amine (various)	0.5-1.0 pt	0.25-0.5 lb ae	4	**	48 hours
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Comments: Labeled for millet and forage sorghum. Apply 2,4-D to emerged broadleaf weeds 3-4 inches tall. Apply low volatile esters from October through March. Use only non-volatile AMINE formulations from late March through September. Do not make applications when circumstances favor movement from treatment site to sensitive areas.

Forage sorghum: Apply 0.25 to 0.5 lb ae/A postemergence when crop is 6 to 15 inches tall. If forage sorghum is more than 8 inches tall (top of canopy), use drop nozzles to keep spray from the growing point. Do not use with oil or other adjuvants. Do not treat during boot, flowering, or dough stage. Do not permit meat or dairy animals to consume treated crop as fodder or forage for 30 days following application. Do not make more than 1 application per crop cycle. ****Preharvest interval for forage sorghum is 30 days**

Millet: Apply 0.25 to 0.5 lb ae/A after crop is fully tillered, but before boot stage of growth (usually 4 to 8 inches tall). Do not apply before tillering or from early boot through milk stage of growth. Do not make more than 1 application per crop cycle. Do not apply more than 0.5 lb ae/A (1 pt/A) per application. For preharvest applications, do not apply more than 0.5 lb ae/A (1 pt/A). ****Preharvest interval for millet is 14 days.**

Ryegrass: Apply 0.25 to 0.5 lb ae/A after crop is fully tillered, but before boot stage of growth (usually 4 to 8 inches tall). Do not apply before tillering or from early boot through milk stage of growth. Do not make more than 1 application per crop cycle. Do not apply more than 0.5 lb ae/A (1 pt/A) per application. For preharvest applications, do not apply more than 0.5 lb ae/A (1 pt/A). ****Preharvest interval for ryegrass is 14 days.**

Interval After Herbicide Application Before Grazing, Haying, or Removal for Slaughter

Herbicide	Time Interval (days) ¹				
	Grazing			Removal before Slaughter ³	Hay Cutting
	Lactating Dairy	Beef	Other Animals ²		
Aim	0	0	0	0	0
Arsenal	0	0	0	---	7
Banvel/Clarity					
up to 1 pt/A	7	0	0	30	37
up to 2 pt/A	21	0	0	30	51
up to 4 pt/A	40	0	0	30	70
Chaparral	0	0	0	3	14
Cimarron Max	7	0	0	30	37
Cimarron Plus/Chisum	0	0	0	0	0
Crossbow	Next Growing Season	0	0	3	14
Diuron	70	70	70	---	70
DuraCor	14	14	14	3	14
Facet	0	0	0	---	7
Freelexx	---	---	---	---	7
Garlon 3A	Next Growing Season	0	0	3	14
GrazonNext HL	0	0	0	3	14
Gramoxone SL	---	---	---	---	40
Glyphosate	---	---	---	---	0
Graslan	7	0	0	3	30
Huskie	7	7	7	---	7
Impose/Panoramic	---	---	---	---	---
Metsulfuron	0	0	0	0	0
Milestone ⁴	0	0	0	3	14
Outrider	0	0	0	---	14
Panoramic	---	---	---	---	---
Pastora	0	0	0	0	0
PastureGard HL	Next Growing Season	0	0	3	14
Prowl H2O	0	0	0	0	0
Remedy Ultra	Next Growing Season	0	0	3	14
Rezilon	0	0	0	0	0 (40 if >3.0 fl oz/A)
Sandea	0	0	0	0	37
Spike	0	0	0	---	365
Stinger ⁵	0	0	0	---	0
Starane Ultra	0	0	0	2	7
Surmount ⁷	14	0	0	3	0 ⁸
Velpar	60	60	60	---	60
Weedmaster	7	0	0	30	37
Yukon	0	0	0	0	37
2,4-D (various)	7	0	0	3	7

¹--- no information provided by the label.

²Other animals include goats, horses, and sheep.

³For the removal period indicated animals for slaughter should be withdrawn from treated areas or consumption of hay harvested from treated areas.

⁴Do not use or transfer treated plant residues, including hay or straw from treated areas, or manure from animals that have grazed forage or eaten hay harvested from treated areas within the previous 3 days, in compost or mulch that will be spread to areas where broadleaf crops may be grown. Manure from animals that have grazed forage or eaten hay harvested from treated areas within the past 3 days may only be used pasture grasses, grass grown for seed, and wheat.

⁵Do not transfer livestock from treated grazing areas (or feeding of treated hay) to sensitive broadleaf crop areas without first allowing 7 days of grazing in an untreated area (or feeding of untreated hay), manure and urine may contain enough clopyralid to cause injury to sensitive broadleaf crops

⁶Do not harvest hay from the treated area until the next growing season for consumption by lactating dairy cattle.

⁷Do not transfer livestock from treated grazing areas (or feeding of treated hay) to sensitive broadleaf crop areas without first allowing 7 days of grazing in an untreated area (or feeding of untreated hay), manure and urine may contain enough picloram to cause injury to sensitive broadleaf crops

⁸Do not harvest hay from treated area for consumption by lactating dairy animals within 14 days after application.

Plant-back Restrictions Following Herbicide Application in Forage Grasses

Herbicide	Time Interval (months)				
	Clovers ¹	Wheat	Oats	Tall Fescue	Annual Ryegrass
Aim	0	0	0	0	0
Arsenal	12 + Soil Assay ¹⁰	12 + Soil Assay ¹⁰	12 + Soil Assay ¹⁰	12 + Soil Assay ¹⁰	12 + Soil Assay ¹⁰
Banvel/Clarity	12	4	4	4	4
Chaparral	Soil Assay ⁹	0	12	0	4
Cimarron Max	4	1	10	4	4
Cimarron Plus/Chisum	4	1	10	4	4
Crossbow	Soil Assay ⁷	3 weeks	3 weeks	3 weeks	3 weeks
Diuron	24	24	24	24	24
DuraCor	Soil Assay ⁹	45 days	45 days	15 days	15 days
Facet	10	0	10	10	10
Freelexx	None indicated on label				
Garlon 3A	Soil Assay ⁷	3 weeks	3 weeks	3 weeks	3 weeks
Glyphosate	None indicated on label				
GrazonNext HL	Soil Assay ²	4	4	4	4
Graslan	Soil Assay ⁵	2 ⁴	2 ⁴	Soil Assay ⁵	Soil Assay ⁵
Huskie	Soil Assay ⁹	1	1	1	1
Impose					
<4 oz/A	26	12	18	26	26
5-8 oz/A	30	12	22	30	30
9-12 oz/A	36	12	24	36	36
Metsulfuron	Soil Assay ⁹	1	10	18	6
Milestone ⁴	Soil Assay ²	Fall ³	Fall ³	Fall ³	Fall ³
Outrider	12	0	12	12	12
Panoramic					
<4 oz/A	26	12	18	26	26
5-8 oz/A	30	12	22	30	30
9-12 oz/A	36	12	24	36	36
Pastora	12	4	10	4	4
PastureGard HL	1	4	4	3 weeks	3 weeks
Prowl H2O	12	4	12	10	10
Remedy Ultra	Soil Assay ⁷	3 weeks	3 weeks	3 weeks	3 weeks
Rezilon	Soil Assay ¹¹	22	22	Soil Assay ¹¹	Soil Assay ¹¹
Sandea	9	2	2	2	2
Spike	24	24	24	24	12
Stinger	Soil Assay ⁶	0	0	0	0
Surmount	12 ⁸	0	0	0	0
Velpar	None indicated on label				
Weedmaster	4	4	4	4	4
Yukon	9	2	2	2	2
2,4-D (various)	12	4	4	4	4

¹Clover species include red, white, and sweet.

²Do not plant forage legumes until a soil assay has been conducted to determine if aminopyralid residues remaining in the soil will adversely affect establishment.

³If GRAZONNEXT HL or MILESTONE is applied in the spring or early summer, grasses may be planted the following fall when conditions are favorable for grass establishment.

⁴Wait 60 days or 2 months with temperatures above 40 F during that period.

⁵Do not plant any crop except small grains until a soil assay has been conducted to determine if picloram residues remaining in the soil will adversely affect rotational crop establishment.

⁶Do not plant a rotational crop until a soil assay has been conducted and shows that no clopyralid residues remain in the soil.

⁷Do not plant forage legumes until a soil assay has been conducted to determine if triclopyr residues remaining in the soil will adversely affect legume establishment.

⁸After 12 months, a soil assay should be conducted before seeding forage legumes to verify no picloram residues remain in the soil.

⁹Do not plant forage legumes until a soil assay has been conducted to determine if herbicide residues remaining in the soil will adversely affect legume establishment.

¹⁰Following 12 months after ARSENAL application and before planting any crop, a successful field bioassay must be completed. See label for more information.

¹¹Following 22 months after REZILON application, a successful field bioassay must be completed. See label for more information.

Weed Response¹ to Herbicides for Weed Management in Grass Forages

	Lifecycle ²	PRE		POST												
		Prowl H2O	Rezilon	Banvel/Clarity	Chaparral	Cimarron MAX	Cimarron Plus	Crossbow	Facet	Glyphosate	Gramoxone SL	GrazonNext HL	Grasalan	Impose	Metsulfuron	Milestone
alligatorweed	P	P	---	P	--	--	--	E	G	G	P	--	--	---	---	---
amaranth, spiny	A	FG	E	GE	E	E	E	E	P	E	F	E	GE	G	E	G
apple, tropical soda	P	P	---	FG	E	P	P	F	P	P	P	E	GE	P	P	E
bahiagrass	P	P	---	P	G	FG	G	P	P	FG	P	P	P	PF	G	P
barley, little	A	P	E	P	P	P	P	P	---	GE	FG	P	P	---	P	P
bedstraw, smooth	A	F	---	P	G	P	P	G	G	G	F	E	E	G	P	E
blackberry/dewberry	P	P	P	FG	GE	F	GE	G	P	P	PF	P	F	P	GE	G
broomsedge	P	P	P	P	P	P	P	P	---	FG	P	P	P	P	P	P
boneset, lateflower	P	---	---	G	---	---	---	G	---	G	F	---	G	---	---	---
bullrush/soft rush	P	P	P	---	---	---	---	---	P	P	P	P	---	---	---	P
buttercup	A	P	---	P	GE	E	E	E	---	FG	G	E	E	---	E	GE
carrot, wild	B	P	---	---	G	---	G	---	---	FG	G	FG	GE	G	G	FG
cheat	A	G	E	P	P	P	P	P	---	E	G	P	P	G	P	P
chickweed, common	A	F	---	E	E	E	E	F	---	G	E	F	F	---	E	F
cocklebur, common	A	P	P	E	E	E	E	E	P	E	G	E	E	---	E	E
crabgrass	A	G	E	P	P	P	P	P	GE	E	F	P	P	E	P	P
croton, woolly	A	P	---	E	GE	E	G	E	---	P	P	E	E	---	G	E
cudweed	A	P	---	E	G	G	G	E	---	P	P	E	G	---	---	E
dallisgrass	P	P	P	P	P	P	P	P	FG	GE	P	P	P	F	P	P
dandelion	P	P	---	E	GE	GE	GE	E	---	P	P	GE	E	---	GE	P
dock, curly	P	P	P	E	E	E	E	G	---	P	P	E	E	---	E	E
dodder	A	P	---	P	---	---	---	P	---	P	G	---	---	---	---	---
dogbane, hemp	P	P	P	F	P	P	P	FG	---	P	P	P	F	---	---	P
dogfennel	P	P	P	FG	P	F	F	E	---	P	P	G	G	---	F	PF
eveningprimrose, cutleaf	A	P	---	E	G	G	G	E	---	F	PF	E	E	---	G	E
falsedandelion, Carolina	B	P	---	E	GE	GE	GE	E	---	P	P	GE	E	---	GE	P
fingergrass	A	P	E	P	P	P	P	P	GE	G	P	P	P	---	P	P
foxtail, knotroot	P	P	P	P	P	P	P	P	FG	FG	P	P	P	PF	P	P
foxtail, yellow	A	F	E	P	P	P	P	P	GE	G	F	P	P	FG	P	P
garlic, wild	P	P	P	E	G	GE	G	---	---	P	E	G	F	---	G	P
geranium, Carolina	A	P	---	---	G	G	---	---	---	P	P	E	E	---	---	E
goldenrod	P	P	---	G	P	P	P	G	---	P	P	G	G	---	P	G
goosegrass	A	G	E	P	P	P	P	P	GE	E	F	P	P	E	P	P
greenbriar (smilax)	P	P	P	F	---	---	---	P	---	P	P	G	---	---	P	---
henbit	A	FG	---	G	GE	E	E	F	---	F	G	F	PF	---	E	FG
honeysuckle	P	P	P	E	---	---	---	E	---	P	P	F	---	---	---	---
horsenettle	P	P	P	G	E	F	PF	PF	---	P	P	E	GE	P	PF	E
horseweed	A	P	---	E	G	F	F	G	---	G	P	E	E	P	F	E
Johnsongrass	P	FG	P	P	P	P	P	P	G	E	FG	P	P	G	P	P

¹Key to Response Ratings: E = excellent control, 90% or better; G=good control, 80-90%; F=fair control, 70-80%; P=poor control, less than 70%; ---=Insufficient data.

²Abbreviations: A = Annual; B = Biennial; P = Perennial.

Weed Response¹ to Herbicides for Weed Management in Grass Forages (cont)

	Lifecycle ²	PRE		POST												
		Prowl H2O	Rezilion	Banvel/Clarity	Chaparral	Cimarron MAX	Cimarron Plus	Crossbow	Facet	Glyphosate	Gramoxone SL	GrazonNext HL	Grasalan	Impose	Metsulfuron	Milestone
kudzu	P	P	P	G	G	PF	PF	FG	P	P	P	G	F	P	PF	G
lespedeza, sericea	P	P	P	P	P	FG	GE	PF	P	P	P	---	P	---	GE	---
lettuce, prickly	B	P	---	---	E	---	---	---	P	FG	---	E	E	F	---	E
mint, perilla	A	P	---	GE	GE	G	---	GE	P	---	FG	GE	E	---	---	P
mustard, wild	A	P	---	G	---	---	---	G	---	F	G	G	GE	---	G	G
nutsedge	P	P	P	P	P	P	P	P	P	FG	PF	P	P	GE	P	P
orange, trifoliolate	P	---	P	---	GE	---	---	---	P	F	P	---	---	---	---	GE
palmetto	P	P	P	F	P	P	P	---	P	P	P	---	---	P	P	P
panicum, Texas	A	FG	E	P	P	P	P	P	GE	GE	G	P	P	PF	P	P
passionflower, maypop	P	P	P	P	P	P	P	P	P	P	P	P	F	P	P	P
pear, prickly	P	P	P	F	P	P	P	---	P	PF	P	P	P	P	P	P
pepperweed, Virginia	A	FG	---	E	---	---	---	---	---	---	G	G	E	---	---	P
persimmon	P	P	P	G	---	P	P	G	P	---	P	P	F	P	---	P
pigweeds	A	FG	E	E	E	E	E	E	P	E	G	E	G	G	E	E
plantains	P	P	P	E	E	E	E	G	P	---	P	G	FG	G	E	P
pokeweed, common	P	P	P	E	P	---	P	G	P	PF	P	G	F	---	F	F
radish, wild	A	P	---	E	GE	GE	GE	E	---	FG	P	G	---	E	GE	P
ragweed, common	A	P	P	E	E	G	G	E	---	FG	G	E	E	F	G	E
rescuegrass	A	---	E	P	P	P	P	P	GE	G	F	P	P	---	P	P
rose, Cherokee	P	P	P	---	GE	---	---	---	P	---	P	E	FG	P	---	GE
rustweed	P	P	P	G	G	G	G	G	---	G	F	G	G	---	G	G
ryegrass, annual	A	G	E	P	P	P	P	P	---	GE	FG	P	P	F	P	P
sandbur	A	G	E	P	P	P	P	P	GE	GE	FG	P	P	FG	P	P
shepherdspurse	A	F	---	E	---	---	---	E	---	G	G	E	E	E	G	P
sicklepod	A	P	---	E	G	G	G	E	---	G	E	GE	E	FG	G	P
sida, arrowleaf	A	P	---	G	---	G	G	PF	---	P	P	E	E	F	F	P
sida, prickly	A	P	---	G	---	G	G	PF	---	P	P	E	E	F	F	P
smartweed	A	P	---	G	GE	E	E	GE	---	G	E	E	E	---	E	E
smutgrass	P	P	P	P	P	P	P	P	FG	G	P	P	P	P	P	P
sneezeweed, bitter	P	P	P	E	E	E	E	E	P	GE	---	E	E	---	---	GE
sorrel, red	P	P	P	G	E	G	GE	E	P	FG	PF	E	---	---	E	---
spurge, nodding	A	P	---	P	P	E	E	P	P	FG	F	P	P	P	E	P
spurry, corn	A	---	---	---	---	---	E	---	---	---	---	---	---	---	---	---
swinecress	A	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
thistles	B	P	---	G	E	G	F	E	P	G	G	E	E	---	F	E
torpedograss	P	P	P	P	P	P	P	P	F	G	P	P	P	F	P	P
trumpetcreeper	P	P	P	F	P	P	P	P	P	P	P	P	F	P	P	P
vaseygrass	P	P	P	P	P	P	P	P	FG	FG	P	P	P	FG	F	P
vervain, blue	P	P	P	---	---	---	---	---	P	---	P	G	G	---	---	F

¹Key to Response Ratings: E = excellent control, 90% or better; G=good control, 80-90%; F=fair control, 70-80%; P=poor control, less than 70%; ---=Insufficient data.

²Abbreviations: A = Annual; B = Biennial; P = Perennial.

Weed Response¹ to Herbicides for Weed Management in Grass Forages (cont)

	Lifecycle ²	POST											
		Outrider	Pastora	PastureGard HL	Remedy/Garlon	Sandea	Stinger	Surmount	Telar XP	Velpar	Weedmaster	Yukon	2,4-D/Freelexx
alligatorweed	P	---	---	---	E	---	---	---	---	---	---	---	P
amaranth, spiny	A	P	GE	PF	---	G	---	GE	---	FG	E	GE	FG
apple, tropical soda	P	P	P	G	G	P	---	E	---	F	F	FG	P
bahiagrass	P	P	P	P	P	P	P	P	---	P	P	P	P
barley, little	A	P	---	P	P	P	---	P	---	P	P	P	P
bedstraw, smooth	A	---	P	G	P	---	P	G	F	---	P	P	P
blackberry/dewberry	P	P	G	G	GE	P	P	G	GE	F	PF	FG	P
broomsedge	P	P	---	P	P	P	P	P	---	P	P	P	P
boneset, lateflower	P	---	---	---	---	P	---	---	---	---	G	G	G
bullrush/soft rush	P	P	---	P	---	P	P	---	---	---	---	---	GE
buttercup	A	P	E	F	E	---	---	G	---	G	E	P	E
carrot, wild	B	P	G	---	---	---	---	FG	F	---	---	---	---
cheat	A	P	G	P	P	P	P	P	P	P	P	P	P
chickweed, common	A	P	E	F	E	P	---	GE	---	E	E	E	F
cocklebur, common	A	P	E	GE	G	G	G	E	---	GE	E	E	G
crabgrass	A	P	GE	P	P	P	P	P	P	P	P	P	P
croton, woolly	A	P	E	F	G	---	---	E	---	P	E	E	GE
cudweed	A	P	GE	G	E	---	---	G	---	---	G	E	F
dallisgrass	P	P	FG	P	P	P	P	P	P	P	P	P	P
dandelion	P	P	G	GE	E	P	G	E	---	E	E	E	E
dock, curly	P	P	GE	F	E	P	F	G	---	P	E	E	F
dodder	A	P	---	P	P	P	---	---	---	---	PF	P	P
dogbane, hemp	P	P	---	FG	F	P	---	G	---	---	F	F	PF
dogfennel	P	P	P	E	GE	P	---	E	---	G	G	FG	FG
eveningprimrose, cutleaf	A	P	F	G	E	---	---	E	E	E	E	E	E
falsedandelion, Carolina	B	P	G	GE	E	---	---	E	---	E	E	E	E
fingergrass	A	P	---	P	P	P	P	P	P	P	P	P	P
foxtail, knotroot	P	P	F	P	P	P	P	P	P	---	P	P	P
foxtail, yellow	A	P	G	P	P	P	P	P	---	P	P	P	P
garlic, wild	P	P	---	P	---	---	P	P	---	---	G	E	GE
geranium, Carolina	A	P	G	---	---	---	---	E	---	---	E	---	E
goldenrod	P	P	G	G	G	P	---	G	---	---	GE	G	F
goosegrass	A	P	GE	P	P	P	P	P	P	P	P	P	P
greenbriar (smilax)	P	P	---	G	P	P	---	F	---	F	F	F	P
henbit	A	P	E	GE	F	---	---	G	GE	GE	P	G	G
honeysuckle	P	P	---	P	PF	P	---	G	---	---	E	E	E
horsenettle	P	P	P	F	FG	P	---	E	---	---	F	G	P
horseweed	A	P	---	G	G	P	G	E	---	F	E	E	F
Johnsongrass	P	E	GE	P	P	P	P	P	P	P	P	P	P

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²Abbreviations: A = Annual; B = Biennial; P = Perennial.

Weed Response¹ to Herbicides for Weed Management in Grass Forages (cont)

	Lifecycle ²	POST											
		Outrider	Pastora	PastureGard HL	Remedy/Garlon	Sandea	Stinger	Surmount	Telar XP	Velpar	Weedmaster	Yukon	2,4-D/Freelexx
kudzu	P	P	FG	F	F	P	--	F	--	--	F	G	PF
lespedeza, sericea	P	--	--	E	GE	P	--	--	--	--	P	P	P
lettuce, prickly	B	P	--	--	--	P	G	E	--	--	--	--	--
mint, perilla	A	--	--	F	FG	--	--	F	--	--	FG	GE	PF
mustard, wild	A	--	--	G	G	P	P	GE	--	--	GE	G	GE
nutsedge	P	E	P	P	P	GE	--	P	P	P	P	GE	P
orange, trifoliolate	P	--	--	--	GE	P	--	--	--	--	--	--	--
palmetto	P	--	--	G	F	P	--	P	--	P	PF	F	P
panicum, Texas	A	P	GE	P	P	P	P	P	P	P	P	P	P
passionflower, maypop	P	P	P	G	F	P	P	P	--	--	PF	P	P
pear, prickly	P	P	--	F	G	P	--	E	--	P	PF	F	P
pepperweed, Virginia	A	P	--	G	P	P	--	G	--	E	E	E	G
persimmon	P	P	--	F	F	P	--	GE	--	F	F	G	P
pigweeds	A	P	E	F	E	G	P	GE	E	G	E	E	GE
plantains	P	P	F	F	F	P	--	F	--	FG	E	E	E
pokeweed, common	P	P	--	P	P	F	--	G	--	--	E	E	G
radish, wild	A	P	GE	GE	E	G	--	E	--	E	E	E	G
ragweed, common	A	N	E	E	E	G	G	E	--	F	E	E	E
rescuegrass	A	P	--	P	P	P	P	P	P	P	P	P	P
rose, Cherokee	P	P	--	P	--	P	--	E	--	--	--	--	--
rustweed	P	P	GE	--	G	--	--	--	--	--	--	--	F
ryegrass, annual	A	P	GE	P	P	P	P	P	F	G	P	P	P
sandbur	A	P	GE	P	P	P	P	P	P	P	P	P	P
shepherdspurse	A	P	--	G	E	F	--	G	--	E	E	E	E
sicklepod	A	P	E	GE	E	P	G	E	G	--	E	E	G
sida, arrowleaf	A	P	--	F	P	F	--	E	--	--	E	G	G
sida, prickly	A	P	--	F	P	F	--	E	--	--	E	G	G
smartweed	A	P	G	--	--	F	--	--	--	FG	G	G	F
smutgrass	P	P	P	P	P	P	--	P	P	GE	P	P	P
sneezeweed, bitter	P	P	GE	E	E	P	--	E	--	--	E	E	E
sorrel, red	P	P	--	F	E	P	G	E	--	--	G	G	P
spurge, nodding	A	P	E	P	P	--	P	P	--	--	P	P	P
spurry, corn	A	P	--	--	--	P	--	--	E	--	--	--	G
swinecress	A	P	--	--	--	P	--	--	--	--	--	--	G
thistles	B	P	G	GE	E	P	E	GE	--	E	E	G	E
torpedograss	P	--	--	P	P	P	P	P	P	P	P	P	P
trumpetcreeper	P	P	P	F	F	P	P	P	--	P	P	F	P
vaseygrass	P	P	FG	P	P	P	P	P	P	P	P	P	P
vervain, blue	P	P	--	--	--	P	--	E	--	--	E	--	E

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PASTURE AND HAY INSECT MANAGEMENT

Jay Crouch, Area Agronomy Agent and Brian Beer, Area Livestock Agent

Insect pests of pastures, hay fields and some forage crops are often difficult to notice and may take growers by surprise. Scout these crops on a regular basis. For all pests listed, younger, smaller insects are the easiest to control! *Note individual product restrictions and consider control costs carefully.*

Insect resistance management: Repeated use of certain insecticides can lead to resistance in insect populations. Growers are strongly encouraged to rotate products with differing modes of action within a crop year. Consult your product labels and your local Extension Agent for resistance management strategies. Use the IRAC numbers – different numbers indicate differing modes of action!

Non-Grass Animal Feed (forage, fodder, straw and hay) Group, including alfalfa, various clovers and vetches, other forage legumes see the product labels

ARMYWORMS [True Armyworms (*Pseudaletia unipuncta*), Fall Armyworms (*Spodoptera frugiperda*), Yellowstriped Armyworm (*S. ornithogalli*), Southern Armyworm (*S. eridania*), and others]

General Comments: For best results apply materials used when larvae are less than ½ inch long. Use high spray volume; increase spray volume (*addition of water only*) for large worms and in hot, dry weather. If possible, cut hay before treatment. Apply as late in the day as possible. These species show some resistance to many pesticides. *Check for efficacy after application!*

Pesticide	Product/acre	REI	PHI	Comments
Beta-cyfluthrin R Baythroid XL	1.6 – 2.8 fl oz/ac	12 hr	7 d grazing and hay harvest	IRAC Group 3 insecticide Maximum 5.6 fl oz/cutting. Maximum application of 22.4 oz/acre for growing season. <i>Minimum five (5) days between applications.</i>
Carbaryl Sevin (various formulations, for example 50WP, 80S)	<i>See product label</i>	12 hr	7 d before harvest or grazing for alfalfa, clovers, birdsfoot trefoil 14 d for pasture	IRAC Group 1A insecticide NOTE: Carbaryl has not given acceptable control in some parts of the state. Results on fall armyworm should be carefully noted because of the potential for resistance in this species. See your county agent for local control history. Best to apply 24 – 48 hrs before expected rain because of potential product wash-off. See wash-off resistance information on label (if present.) Numerous formulations of Carbaryl are available. Consult label for use rates.

ARMYWORMS [True Armyworms (*Pseudaletia unipuncta*), Fall Armyworms (*Spodoptera frugiperda*), Yellowstriped Armyworm (*S. ornithogalli*), Southern Armyworm (*S. eridania*), and others] (cont)

Pesticide	Product/acre	REI	PHI	Comments
Chlorantraniliprole Prevathon	14-20 oz/ac	4 hr	0 d	IRAC Group 28 Insecticide Do not make more than 4 applications per year. Only one application per cutting. Do not apply more than 60 oz/A of Prevathon per year.
Chlorantraniliprole (Rynaxypyr) Coragen	3.5 – 5.0 oz/ac	4 hr	0 d	IRAC Group 28 Insecticide Protect surface waters with buffer zone; recommend apply 48 hrs before expected rainfall. Apply at egg-hatch or when newly hatched larvae are present before damaging populations develop. Maximum application of 15.4 oz/acre per crop. One (1) application per cutting. Maximum four (4) applications per acre per season.
Lambda-cyhalothrin R Karate, Silencer, others	2.56 – 3.84 oz/ac	24 hrs	1 d grazing 7 d hay harvest	IRAC Group 3 insecticide Do not apply more than 0.96 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Karate Z	1.28 – 1.92 oz /ac	24 hrs	1 d grazing 7 d hay harvest	Do not apply more than 0.48 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Lambda-cyhalothrin R + Chlorantraniliprole Besiege	6.0-9.0 oz/ac	24 hrs	1 d grazing 7 d harvest	IRAC Group 3 and 28 insecticide Do not exceed 31.0 oz/acre/year. Do not apply more than 10 oz/cutting. Apply a minimum of 10 GPA by ground.
Methomyl R Lannate LV Lannate SP <i>Water soluble powder in water soluble bags</i>	<i>Alfalfa</i> : 1.5 – 3.0 pts / ac <i>Alfalfa</i> : 0.5 – 1 lb / ac	48 hrs	<i>Alfalfa: Last appl. 7 d before cutting or grazing</i>	IRAC Group 1A insecticide <i>Read label carefully!</i> Lannate LV: <i>Alfalfa - See label!</i> Do not apply more than 12 pts per acre per crop, or make more than 10 applications Lannate SP: <i>Alfalfa - See label!</i> Do not apply more than 4 lbs per ac per crop or more than 10 applications per crop
Zeta-cypermethrin R Mustang Max Mustang Max EC Respect	2.8 – 4.0 oz / ac	12 hr	3 d grazing 3 d hay harvest	IRAC Group 3 insecticide <i>RUP: toxicity to fish & aquatic organisms. See label for buffer zones, other info. Minimum 7 days between applications</i> Maximum season total/ac for non-grass animal feeds (alfalfa, forage, fodder...) is: 12.0 oz /ac/season. Note label spray volume recommendations. See label for maximum use when applying both zeta-cypermethrin and cypermethrin products to the same crop within the same season.

GRASSHOPPERS

General Comments: Nymphs easier to kill than adults. May need to apply to grass and field edges.

Pesticide	Product/acre	REI	PHI	Comments
Beta-cyfluthrin R Baythroid XL	2.0 – 2.8 oz/ac	12 hr	7 d Pre-harvest/ pre-graze	IRAC Group 3 insecticide Maximum 5.6 fl oz/cutting. Maximum application of 22.4 oz/acre for growing season. <i>Minimum five (5) days between applications.</i>
Carbaryl Various Formulations	See Product Label	12 hr	7 d before harvest or grazing for alfalfa, clovers, birdsfoot trefoil 14 d for pasture	IRAC Group 1A insecticide Sevin 4F - <i>*Note labeled use: "Pastures and grass grown for seed."</i> Various formulations of Carbaryl are available. Consult label for proper use requirements.
Lambda-cyhalothrin R Karate, Silencer and others	2.56 – 3.84 oz/ac	24 hrs	1 d grazing 7 d hay harvest	IRAC Group 3 insecticide Do not apply more than 0.96 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Karate Z	1.28-1.92 oz /ac	24 hrs	1 d grazing 7 d hay harvest	Do not apply more than 0.48 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Dimethoate Dimethoate 2.67 Dimethoate 4EC	 0.75 – 1.5 pts/ac 0.5 – 1.0 pt/ac	48 hr	10 d for pasture or hay	IRAC Group 1B insecticide Do not apply when crop or weeds are blooming or bees are foraging Only one application per year Only one (1) application per cutting. Do not apply within 10 days of grazing or cutting
Zeta-cypermethrin R Mustang Max Mustang Max EC Respect	 2.8 – 4.0 oz /ac	12 hr	3 d grazing 3 d hay harvest	IRAC Group 3 insecticide <i>RUP: toxicity to fish & aquatic organisms. See label for buffer zones, other info.</i> <i>Minimum 7 days between applications</i> Maximum season total/ac for non-grass animal feeds (alfalfa, forage, fodder...) is: 12.0 oz /ac/season. Note label spray volume recommendations. See label for maximum use when applying both zeta-cypermethrin and cypermethrin products to the same crop within the same season.

For true armyworm and fall armyworm make applications late in the day. This reduces breakdown of your chemical by daylong exposure to sunlight and puts the most chemical on plants closest to when these species feed.

Grass Forage, Fodder and Hay Group and Grass Grown for Seed and Pasture and Rangeland
(see the labels)

ARMYWORMS [True Armyworms (*Pseudaletia unipuncta*), Fall Armyworms (*Spodoptera frugiperda*), Yellowstriped Armyworm (*S. ornithogalli*), Southern Armyworm (*S. eridania*), and others

General Comments: For best results apply materials used when larvae are less than ½ inch long (first and second instar larvae). Use high spray volume; increase spray volume (addition of water only) for large worms and in hot, dry weather. If possible, cut hay before treatment. If possible, apply late in the day. These species show some resistance to many pesticides. Check for efficacy after application!

Insect resistance management: Repeated use of certain insecticides can lead to resistance in insect populations. Applicators are encouraged to rotate products with differing modes of action within a crop year. Consult your local Extension Agent for resistance management strategies.

Pesticide	Product/acre	REI	PHI	Comments
Beta-cyfluthrin R Baythroid XL	First two instars true armyworm: 1.6 – 1.9 fl oz/ac First two instars of all other armyworms: 2.6 – 2.8 fl oz/ac	12 hr	0 d grazing and hay harvest	IRAC Group 3 insecticide Maximum application of 11.3 oz/acre for growing season for grazing or hay harvest. <i>Minimum five (5) days between applications.</i>
Carbaryl Sevin (various formulations)	See product label	12 hr	7 d before harvest or grazing for alfalfa, clovers, birdsfoot trefoil 14 d for pasture	IRAC Group 1A insecticide <i>NOTE: Carbaryl has not given acceptable control in some parts of the state. Results on fall armyworm should be carefully noted because of the potential for resistance in this species. See your county agent for local control history.</i> Best to apply 24 – 48 hrs before expected rain because of potential product wash-off. See wash-off resistance information on label (if present.). Numerous formulations of Carbaryl are available. Consult label for use rates.
Chlorantraniliprole Prevathon	14-20 oz/ac	4 hr	0 d	IRAC Group 28 Insecticide Do not make more than 4 applications per year. Only one application per cutting. Do not apply more than 60 oz/A of Prevathon per year.
Chlorantraniliprole (Rynaxypyr) Coragen	3.5 – 5.0 oz/ac	4 hr	0 d	IRAC Group 28 Insecticide Protect surface waters with buffer zone-recommend 100 ft.; recommend not apply less than 48 hrs before expected rainfall. Apply at egg-hatch or when newly hatched larvae are present before damaging populations develop. Maximum application of 15.4 oz/acre per crop. Minimum seven (7) days between treatments. Maximum four (4) applications per acre per season.

R = Restricted use; **REI** = re-entry interval; **PHI** = pre-harvest interval

ARMYWORMS [True Armyworms (*Pseudaletia unipuncta*), Fall Armyworms (*Spodoptera frugiperda*), Yellowstriped Armyworm (*S. ornithogalli*), Southern Armyworm (*S. eridania*), and others (cont)]

Pesticide	Product/acre	REI	PHI	Comments
Diflubenzuron R Dimilin 2L	2.0 oz/ac	12 hrs	1 d hay harvest. 1 d grazing.	IRAC Group 15 insecticide Do not exceed 6 oz per acre per year. For maximum control apply to < ½ inch larvae. Use high spray volume – see label
Lambda-cyhalothrin R Karate, Silencer and Others	2.56 – 3.84 oz/ac	24 hrs	0 d grazing, 7 d hay harvest	IRAC Group 3 insecticide Do not apply more than 0.72 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Karate Z	1.28-1.92 oz / ac	24 hrs	0 d grazing, 7 d hay harvest	Do not apply more than 0.36 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Methomyl R Lannate LV Lannate SP Water soluble powder in water soluble bags	<i>Bermuda pasture:</i> 0.75 – 3.0 pts /ac <i>Bermuda pasture:</i> 0.25 – 1 lb /ac	48 hrs	<i>Bermuda pasture:</i> Last appl. 7 d before feeding forage, grazing; 3 d cutting dry hay	IRAC Group 1A insecticide Lannate LV: <i>Bermuda pasture:</i> Do not apply more than 3 pts/ac per crop per year or 4 applications per crop. Lannate SP: <i>Bermuda pasture:</i> Do not apply more than 1lb per crop or make more than 4 applications per year.
Methoxyfenozide Intrepid	4.0-8.0 oz / ac	4 hrs	0 d grazing, 7 d hay harvest.	IRAC Group 18 insecticide No more than one (1) application per cutting. Do not apply more than 32 oz per year.
Spinosad Tracer Naturalyte	1-2 oz / ac	4 hrs	Allow spray to dry before grazing. 3 d hay harvest.	IRAC Group 5 insecticide Do not apply more than 6 oz per acre per season.
Zeta-cypermethrin R Mustang Max Mustang Max EC	2.8 – 4.0 oz / ac	12 hr	Grass forage & hay 0 d Grass straw & screenings 7 d	IRAC Group 3 insecticide <i>RUP: toxicity to fish & aquatic organisms. See label for buffer zones, other info.</i> Apply in sufficient water to ensure thorough coverage of foliage; increase water in hot dry, weather. <i>Minimum 7 days between applications for forage & hay, 17 days for straw, screenings, other. Do not spray livestock. Allow application to dry before letting livestock graze on treated area.</i> Maximum seasonal total/ac for grass forage, fodder, and hay group and grass grown for seed is: Hay : 17.2 oz / ac / season; Forage, straw & seed screenings: 21.5 oz /ac/season.

R = Restricted use; REI = re-entry interval; PHI = pre-harvest interval

GRASSHOPPERS and CHINCH BUGS

General Comments: Nymphs easier to kill than adults. May need to apply to grass and field edges.

Pesticide	Product/acre	REI	PHI	Comments
Beta-cyfluthrin R Baythroid XL	2.6 – 2.8 oz/acre	12 hr	0 d grazing and hay harvest	IRAC Group 3 insecticide Maximum application of 11.3 oz/acre for growing season. <i>Minimum five (5) days between applications.</i>
Carbaryl Various formulations	See Product Label	12 hr	14 d	IRAC Group 1A insecticide Best to apply 24 – 48 hrs before expected rain because of potential product wash-off. See wash-off resistance information on label (if present.) Various formulations of Carbaryl are available. Consult label for proper use requirements.
Diflubenzuron R Dimilin 2L Dimilin 25W	1.0 – 2.0 oz/acre on early instars 1.0 – 2.0 oz/ac	12 hrs	1 d hay harvest. 1 d grazing.	IRAC Group 15 insecticide <i>Grasshoppers only.</i> Do not exceed 6 oz per acre per year. Use one application on early instar (2 nd – 4 th instar) nymphal stages. Use high rate for pastureland. Use high spray volume – see label. First application at early instar nymphs. Use high rate for pastures. See label for spray volume and addition of oil for hot/dry weather
Lambda-cyhalothrin R Karate, Silencer and others Karate Z	2.56 – 3.84 oz/acre 1.28-1.92 oz per acre	24 hrs	0 d grazing, 7 d hay harvest	IRAC Group 3 insecticide Do not apply more than 0.72 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments. Do not apply more than 0.36 pts per acre per season. Thirty (30) day minimum retreatment interval if crop not harvested between treatments.
Lambda-cyhalothrin R + Chlorantraniliprole Besiege	5.0-9.0 oz/acre	24 hrs	0 d grazing 7 day harvest	IRAC Group 3 and 28 insecticide Do not exceed 27.0 oz/acre/year. Do not apply more than 9 oz/cutting. Apply a minimum of 10 GPA by ground. Wait a minimum of 7 days between applications.
Zeta-cypermethrin R Mustang Max Mustang Max EC	2.8 – 4.0 oz / ac	12 hr	Grass forage & hay 0 d Grass straw & screenings 7 d	IRAC Group 3 insecticide <i>RUP: toxicity to fish & aquatic organisms.</i> See label for buffer zones, other info. Apply in sufficient water to ensure thorough coverage of foliage; increase water in hot dry, weather. <i>Minimum 7 days between applications for forage & hay, 17 days for straw, screenings, other. Do not spray livestock. Allow application to dry before letting livestock graze on treated area.</i> Maximum seasonal total/ac for grass forage, fodder, and hay group and grass grown for seed is: Hay: 17.2 oz / ac / season; Forage, straw & seed screenings: 21.5 oz /ac/season.

R = Restricted use; **REI** = re-entry interval; **PHI** = pre-harvest interval

WEED CONTROL IN PINE STANDS

Stephen Peairs, Extension Forest Specialist

Herbaceous Release of Young Pine Stands:

Some artificially planted pine plantations may experience competition from unwanted vegetation within the few years following establishment. Plants may become problematic from either less than acceptable control from site preparation treatment and re-emergence from off-site invasion or seed germination from the existing soil seed bank. In such cases, herbaceous release is warranted to protect the timber investment from loss. Most herbaceous release applications are conducted either just before or during the early growing season (post-emergent application) pending the herbicide(s) selected. Pine seedling injury is also reduced if certain applications are conducted prior to bud break (pre-emergent application). Late winter or early growing season applications will improve pine first year survival, volume production, maximized seedling height growth, and encourages height growth. Applications (imazapyr) performed after bud break may lead to stunted or reduced growth during that particular growing season. **Applicators should allow at least one month to elapse after planting (for either pre or post-emergent applications) if treating planted loblolly pine and two months for longleaf pine.** Later plantings that occur in March/April will reduce the herbicide selection to only post-emergent applications. The following tables depict individual herbicide and their respective application rates to control various competing plants (grasses, forbs, and woody plants) at various stages of stand development. The application rate for all herbicides presented changes from lowest amount (sandy soils) to highest amount (clay soils). Refer to the label prior to application to ensure weather conditions, application timing, and site variables are accounted for at any given site to receive chemical treatment. **Important Note: longleaf and slash pine are sensitive to the herbicides containing imazapyr and metsulfuron methyl - lower application rates (for imazapyr), avoid metsulfuron applications (aside from within loblolly), do NOT add a surfactant, or substitution of a different herbicide are recommended.**

Table 1. Grass selective herbicides to apply over the top of pine or hardwood seedlings.

Herbicide	Trade Name	Application Rate/Acre Formulation Ingredient	Active	Application Timing	Stand Age & Comments
Clethodim	Envoy®, Intensity One®, SelectMax®	12 – 16 oz.	0.09 – 0.12 lbs.	Early growing season; may take multiple applications to achieve control	Treat grasses when actively growing; maximum treatment height varies by species but most are between 4” – 6” (max)
Flauzifop-P-butyl	Fusilade DX®	8 oz (1 st application) 8 oz. (2 nd application)	0.125 lbs. (per application)	Post emergent (1 st application) Early growing season (2 nd application)	1 st year
Sethoxydim	Segment® Poast® Sethoxydim SPC®	1.5 – 2.5 pints 2.14 (grass <6”) – 3.75 pints (grass 6”-12”)	0.28 – 0.47 lbs.	Post emergent (newly emerged grasses)	Early growing season shortly after grass emerges – regardless of age

Chemical site preparation treatments, when properly applied, can lead to extended vegetation control into the initial growing season after planting. It is important to delay release treatments (utilizing multiple soil active herbicides) until

the onset of the second growing season (after site preparation sprays) to avoid height stunting. Research (Peairs 2022) has suggested that vertical stunting may occur if multiple soil active herbicides are applied for both a site prep and release treatment with six months of each application. Thus, the applicator should wait to apply release treatments between years 2 – 5 after planting (with chemical site preparation). An exception to this rule would be if pine species are planted on non-forest lands containing predominantly grass vegetation. A broad spectrum, **non-soil active** herbicide, such as glyphosate, should be applied as a broadcast or banded application atop of the planting rows. This will deaden the vegetation within the treated area, but the landowner should expect a response by forbs in the subsequent growing season. A forb selective herbicide(s) may be applied at that point to suppress emerging vegetation. ***Note: grass and forb selective herbicides may be incompatible and reduce efficacy when tank mixed; if using both types of selective herbicide, apply at different times.** Table two presents various herbicides (soil active vs. no residual soil activity, pre-emergent & post-emergent) that can be options for vegetation management. All of these herbicides (with exception of imazapyr mixed with hexazinone) are compatible with one another and can be tank mixed to broaden plant species controlled.

Table 2. Forb selective herbicides to apply over the top of pine seedlings.

Herbicide	Trade Name	Application Rate/Acre		Application Timing	Comments
		Formulation	Active Ingredient		
Imazapyr* (see note below)	Arsenal AC® Polaris AC® Alligare 4 SL® (above are 4-lb. acid products (52.4% active ingredient); multiple 2-lb acid products are also available)	4 – 10 oz.	0.125 – 0.313 lbs.	Pre or Post-emergent with residual soil activity; allow at least 1-2 months of time after planting; for hardwood control apply after July 15 th -after Aug. 15 th for longleaf & slash	4-6 oz for slash & longleaf pine (sensitive to imazapyr; use lower rate or substitute hexazinone); can add ¼% surfactant ONLY if weeds have overtopped pine seedlings (species other than longleaf & slash)
Hexazinone	Velossa®, Velpar L®	3.33 – 6.66 pints 4 – 8 pints	0.999 – 1.998 lbs.	Early Post-Emergent Latter March (seedling bud break) – May (before leaves harden off in summer)	Avoid applications during high humidity & temperature (>80°F). Apply to seedlings at least 2 months old. Best on sandy soils
Metsulfuron methyl* (see note below)	Escort XP® MSM60®	1 – 2 oz.	0.6 – 1.2 oz.	Pre-emergent prior to bud break or post emergent	Metsulfuron is both foliar and soil active. Longleaf and slash pine are sensitive to metsulfuron (avoid use – longleaf; reduce rate in slash pine)
Sulfometuron methyl	Oust XP® Spyder® SFM75®	2 – 4 oz	1.5 – 3 oz.	Pre-emergent prior to bud break up to shortly after weed emergence	Various studies have utilized sulfometuron after bud break with successful weed control (against label recommendations but necessary if mixed with hexazinone)

Table 2. Forb selective herbicides to apply over the top of pine seedlings (cont).

Herbicide	Trade Name	Application Rate/Acre Formulation Active Ingredient		Application Timing	Comments
Aminopyralid	Milestone®	4 – 7 oz.	≤ 0.11 lbs.	Pre or Post-emergent: Foliar active with limited soil activity	Broad application timing – across multiple seasons; favorable for preserving grasses
Indaziflam	Espalanda F® Rezilon®	3.5 – 7 oz 3 – 5 oz	≤ 0.091 lbs.	Pre-emergent with residual soil activity	Minimum 25’ buffer (no spray) between water bodies; avoid use in shallow water table areas
Clopyralid	Transline® Sonora® Clopyralid 3® Clean Slate®	0.25 – 1.33 pints	0.94 – 0.50 lbs	Post-emergent foliar contact herbicide; no residual soil activity	Woody control restricted to leguminous species only; safe for most hardwood species
Fluroxypyr	Vista XRT® Flagstaff®	6 – 23 oz	0.13 – 0.50 lbs.	Early Post-emergent foliar application when weeds are growing but less than 6” tall	Can be applied to seasonally dry wetlands but not directly to water (toxic to fish)

Use of one of the soil active herbicides above is recommended to potentially control seed present in the A horizon/detritus layer. Rates will vary pending soil type of targeted area (generally, lower rate for more coarse soils (consisting of sand); higher rate for finer soils (consisting of clay). Refer to the product label for application rates by soil type. Combine one of the above with one or more (pending target species) of the non-soil active herbicides presented below to extend range of species controlled if multiple species of competitor plants are present. Imazapyr or hexazinone can be also mixed with both metsulfuron or sulfometuron methyl. **Do NOT** mix imazapyr with hexazinone as the chemicals are incompatible. **Do NOT** include a surfactant when applying as herbaceous release treatment (for either Pre or Post-emergent applications).

*- herbicides have shown injury to longleaf pine and/or slash pine; findings suggest damage to these species at higher application rates. **Avoid use** of metsulfuron methyl in longleaf stands. Allow **two months** of time to pass after planting before chemical application in **longleaf** stands.

There are pre-mixed commercial herbicide products available to private landowners as well. Table three presents various combinations of previously mentioned herbicides. Applicators may choose these products to reduce contact exposure and save time (and possibly expense) during the chemical mixing process.

Table 3. Commercially pre-mixed products containing individual combinations of selective herbicides.

Herbicide	Trade Name	Application Rate/Acre		Application Timing	Comments
		Formulation	Active Ingredient		
Aminopyralid + metsulfuron methyl	Chaparral® Opensight®	2 – 3.3 oz	0.08 – .128 lbs (aminopyralid) 0.011 – 0.2 lbs (metsulfuron)	For woody control – apply in spring after leaves have fully emerged For general weeds – after plant emergence but <6 inches tall	May also be used as a pre-emergent ; Label specifies range of application timing by plant species; <i>Avoid use on Longleaf</i>
Imazapyr + metsulfuron methyl	Lineage Clearstand®	2.6 – 7.8 oz.	0.1 – 0.31 lbs. 0.016 – 0.046 lbs. (respectively)	Pre-emergent for herbaceous release; Post-emergent for hardwood control (after July 15 th)	May also be used as a pre-emergent
Imazapyr + metsulfuron methyl + sulfometuron methyl	Lineage Prep®	10 – 15 oz. (loblolly) 10 – 11 oz (slash)	0.34 – 0.51 lbs (imazapyr) 0.10 – 0.14 lbs (sulfometuron) 0.03 – 0.04 lbs (metsulfuron)	Slash pine – must be at least 5 years old and apply after Sept. 15; loblolly – at least 1 year old and after July 15	May also be used as a pre-emergent
Hexazinone + Sulfometuron methyl	Oustar® Westar®	10 – 19 oz (1 st growing season) 12 – 24 oz (after 1 st year)	0.4 – 0.75 lbs. (hex) 0.074 – 0.14 lbs. (sulf) 0.47 – 0.95 lbs. (hex) 0.09 – 0.18 lbs (sulf)	Pre or Post-emergent ; Just prior or shortly after weeds have emerged (March/April)	Soil pH greater than 6.0 will have greater soil activity (reduce application rate); pH less than 5.0 will reduce soil activity; 15' buffer (spot sprays) – 50' buffer (broadcast) around riparian areas
Sulfometuron + metsulfuron methyl	Oust Extra® Spyder Extra® SFM Extra®	2 – 4 oz.	1.125 – 2.25 0.3 – 0.6 (respectively)	Pre-emergent 3 – 4 oz (loblolly); 2 – 3 oz (slash)	Soil pH affects application rate; avoid usage in longleaf stands

Mid-Rotation Applications:

Landowners will typically prefer to create aesthetically pleasing, early successional wildlife habitat after pine stands are commercially thinned for the first time. Control of woody stems is necessary to promote and maintain the early successional plant species to create the preferred habitat. In many situations, repeated prescribed fires conducted over time are utilized to accomplish this objective. However, some landowners may choose to avoid fire due to sensitive sites (proximity to nursing homes, schools, etc) or legal liability. Fire alone may not yield acceptable woody control in all situations. The landowner has the option to utilize a mixture of herbicides to achieve woody plant control. Though the herbicides presented in the following table will deaden a variety of woody and forb species, but grass species are less susceptible to some of these herbicides (triclopyr, metsulfuron methyl, aminopyralid) which may be favorable if a grassland understory is desired.

Promotion of pine timber production is another prime land management activity. There are multiple research studies that support the conductance of woody release treatments after the initial commercial thinning. Control of competing vegetation can enhance pine volume production by as much as 30% after 14 years (Shiver 1994). A compilation analysis of studies (Fortson and others 1996) found that on average (33 sites evaluated) volume increased by 20% after 8 years in Piedmont and Coastal Plain regions. Control of encroaching woody plants including hardwood species such as sweetgum, red maple, etc. is a necessity in these management situations. Rotational prescribed fire applied every 2 – 3 years is commonly used to meet these objectives. Sometimes the use of fire may be inhibited or implementation of fire is forgone and vegetation becomes established that may not be adequately controlled with low or moderate intensity burns. Herbicide treatments applied as mid-rotational release can be applied to meet landowner management goals in lieu of fire. The following table depicts potential chemical treatments for mid-rotation release.

Table 4. Mid-rotation release - soil active/non soil active herbicide combinations to apply beneath a pine overstory.

Herbicide	Trade Name	Application Rate/Acre		Application Timing	Additional Comments
		Formulation	Active Ingredient		
Imazapyr	Arsenal AC®, Polaris AC®, Alligare 4 SL®	12 – 20 oz.	0.375 – 0.625 lbs.	August – September (first growing season after thinning)	1% methylated seed oil with organosilicone surfactant
Hexazinone	Velossa®, Velpar L®	1.66 – 5 quarts. 2 – 6 quarts.	0.996 – 3 lbs.	Latter March – May (immediate growing season after thinning)	Best option for sandy soils or species ¹ susceptible to imazapyr
Metsulfuron methyl	Escort XP® MSM60®	1 – 2 oz.	0.6 – 1.2 oz.	Either of the timings listed above (either pre or post-emergent)	Metsulfuron is both is both foliar and soil active

Use of one of the soil active herbicides above is recommended to potentially control seed present in the A horizon/detritus layer. Rates will vary pending soil type of targeted area (generally, lower rate for more coarse soils (consisting of sand); higher rate for finer soils (consisting of clay). Refer to the product label for application rates by soil type. Combine one of the above with one or more (pending target species) of the non-soil active herbicides presented below to extend range of species controlled.

¹- susceptible species included longleaf pine and slash pine; findings suggest damage to these species at higher application rates.

Table 4. Mid-rotation release - soil active/non soil active herbicide combinations to apply beneath a pine overstory (cont).

Herbicide	Trade Name	Application Rate/Acre Formulation Active Ingredient		Application Timing	Additional Comments
Triclopyr (ester or acid formulation)	Garlon 4®	1.5 – 2.5 quarts. (based on 2% - 3% <u>solution in</u> <u>20 gallons</u>)	1.5 – 2.5 lbs.	Foliar active – apply after plants have broken dormancy; optimal control in late summer	Best option for waxy-leaved plant control; Non-ionic surfactant if spring application; oil based surfactant for late summer
	Trycera®	2.1 – 3.5 quarts	1.5 – 2.5 lbs.		
Glyphosate	Numerous 41% a.i. commercial products	2 – 4 quarts.	2 – 4 lbs.	Foliar active – same as above	Non-ionic surfactant if spring application; oil based surfactant for late summer
Aminopyralid	Milestone	4 – 7 oz	≤ 0.11 lbs.	Foliar active with limited soil activity	Safe for loblolly, longleaf, slash, & shortleaf pine
<p>Glyphosate has broadest spectrum of plant control which will be detrimental for early successional herbaceous plant establishment.</p> <p>Triclopyr and aminopyralid are weak on grass species which may be favorable in a grass dominated understory is preferred; avoid using triclopyr ester when temperatures exceed 90°F to avoid volatilization which could result in damage to overstory trees;</p> <p>Apply applications to targeted woody stems that are less than 3 years of age (3 years or less since thinning disturbance)</p>					

Summary:

The immediate control of competing vegetation around both pine seedlings and developing merchantable timber is best achieved by using forestry labeled herbicides. Reduction of competition improves pine growth and performance. In post-thinned pine stands, woody release can also create favorable wildlife habitat. Most herbaceous release treatments can be applied within one (loblolly pine) to two months (longleaf & slash pines). If a chemical site preparation treatment incorporating soil active herbicide(s) was applied, wait until the end of the following growing season or the onset of the upcoming season to apply the herbaceous release in order to avoid seedling height stunting. Earlier tree plantings (mid-February or earlier) may receive either pre-emergent or post-emergent applications. Later planting are restricted to post-emergent applications only. Applicators should incorporate at least one soil-active herbicide into the tank mix to extend the duration of plant control. In the case of imazapyr products, most release applications are made in late summer. Hexazinone applications are best in sandy soils in the early spring. If grass selective herbicide is applied, a secondary application with a soil active, forb herbicide (such as metsulfuron methyl) will be necessary to control re-emerging plants. Subsequent applications may be warranted in succeeding growing seasons should vegetation appear restrictive to the crop trees. In most instances however, pine seedlings should be tall enough by the end of the second or third growing season (pending site quality) to survive. Mid-rotation release treatments can incorporate some contact herbicides (triclopyr, glyphosate, etc) which are cause damage to southern pine species if spray reaches foliage (needles). These applications are conducted with ground applied equipment, however, so minimal damage is expected.

Literature Cited

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SITE PREPARATION FOR PINE REGENERATION

Stephen Peairs, Extension Forest Specialist

Common Forestry Herbicides and mode of action:

Aminopyralid – plant growth regulator

Glyphosate – 5-enolpyruvylshikimate-3-phosphate synthase enzyme (shikimate pathway) inhibitor

Hexazinone – photosynthetic inhibitor

Imazapyr – amino acid branched chain biosynthesis inhibitor

Metsulfuron methyl – acetolactate synthase enzyme inhibitor

Sulfufenacil – protoporphyrinogen-oxidase inhibitor – Group 14 (WSSA)/Group E (HRAC)

Sulfometuron methyl – acetolactate synthase enzyme inhibitor

Chemical Site Preparation Introduction:

Most forestland sites that are scheduled to be artificially regenerated by planting seedlings after a timber harvest will initially need herbicide treatment to deaden both re-emerging woody and herbaceous vegetation in the subsequent growing season. Deadening of this vegetation will alleviate less desirable plant competition for water/nutrient resources and provide more available growing space for planted growing stock. Planted seedlings will have improved survival rates and experience enhanced growth due to the chemical treatments. Individual herbicides presented can be used alone at label recommended rates however a limited range of plant control should be expected. Application of tank mixtures containing two or more herbicides will improve the level of vegetation control in treated areas. The application of at least one soil residual herbicide (imazapyr, hexazinone, metsulfuron methyl, or picloram) should yield adequate control into the following growing season without the need for an additional herbaceous release treatment until the third growing season after disturbance given the site preparation occurs in the initial growing season. Addition of an adjuvant to chemical applications will also improve vegetation control success. For forestry activities, typically either a non-ionic surfactant, methylated seed oil, or a combined manufactured formulation are used for foliar treatments. Selection of the type of adjuvant primarily depends on application conductance in either the first or latter half of the active growing season. The following tables present commonly recommended tank mixtures to be utilized in the southeastern United States.

Site Preparation Tank Mix #1:

Herbicide in Tank Mix	Herbicide Trade Name	Application Rate/Acre		Application Timing	Adjuvants
		Formulation	Active Ingredient		
Imazapyr	Arsenal AC®, Polaris AC®, Imazapyr 4SL®	16 – 32 oz. Max rate of 16 oz. for pine species other than loblolly	0.5 – 1 lb (acid equivalent)	June – Early October (Loblolly/Slash) June – September (Longleaf/Shortleaf)	Methylated Seed Oil (1 – 2.5%) after mid-July Or Non-ionic Surfactant (0.5 – 1%) before mid-July
	Chopper Gen2®, Polaris SP®, Rotary 2SL®	32 – 64 oz Max rate of 32oz. for pine species other than loblolly			
Triclopyr	Garlon XRT®, Boulder 6.3®	20 – 40 oz	0.98 – 1.97 lbs (acid equivalent)	Triclopyr products are best for use on “waxy” leaved plants are present (tank mix with imazapyr)	
	Triclopyr 4®, Garlon 4 Ultra®, Tahoe 4E®	1 – 2 quarts	1 – 2 lbs. (acid equivalent)		

Comments: Allow at least four months of time to elapse between site preparation spraying and pine seedling planting to avoid damage to “sensitive” pine species (longleaf and slash in particular). If incorporation of prescribed fire will be

applied post-spray, wait 6 weeks before burning for desiccation of treated vegetation. Better control on volunteer pine if applied before early August. Greater pine volume growth if applied earlier but better vegetation control if applied later.

Application rates will vary between soil types present on treatment site. Course, sandy soils should have lower application rates but will experience a reduced length of vegetation control (1 – 2 months). Fine textured clay soils require maximum application rates but will have adequate vegetation control up to 4 months after application. Likewise, soils with high organic matter content should also use higher application rates. Aerial applications should deliver a volume of 10 – 15 gallons per acre; ground applied treatments conducted at 25 gallons per acre.

10% “Rule” of imazapyr: apply an additional 10% of product for each month prior to October in first growing season after timber harvest. Ex: if October rate is 16 oz per acre then September application would have an additional 1.6 oz added; August would be 3.2 oz, etc. If site preparation treatment is applied in second growing season after disturbance, applicator should add an extra 10% to October rate (in example, 16 oz per acre): July +10% (17.6 oz per acre), August +20% (19.2 oz per acre), September +30% (20.8 oz per acre) to facilitate deadening of more advanced vegetation. If higher rates are needed to achieve adequate vegetation control, extend the delay period between the chemical application and sensitive pine seedling planting (five months or greater)

Site Preparation Tank Mix #2:

Herbicide in Tank Mix	Herbicide Trade Name	Application Rate/Acre		Application Timing	Adjuvants
		Formulation	Active Ingredient		
Imazapyr	Arsenal AC®, Polaris AC®, Imazapyr 4SL®	16 – 32 oz. Max rate of 16 oz. for pine species other than loblolly	0.5 – 1 lb (acid equivalent)	Late summer after mid-July if combined with the latter two herbicides	Methylated Seed Oil (1 – 2.5%) after mid-July Or Non-ionic Surfactant (0.5 – 1%) before mid-July
	Chopper Gen2®, Polaris SP®, Rotary 2SL®	32 – 64 oz Max rate of 32oz. for pine species other than loblolly			
Sulfometuron methyl	Oust XP®, SFM 75®, Spyder®	2 – 8 oz	1.5 – 6 oz ai		
Metsulfuron methyl	Escort XP®, MSM 60®	1 – 2 oz	0.6 – 1.2 oz ai		
Oust Extra® (combined sulfometuron & metsulfuron) can be substituted and applied at 3 – 4 oz per acre					

Comments: Allow at least four months of time to elapse between site preparation spraying and pine seedling planting to avoid damage to “sensitive” pine species (longleaf and slash in particular). Research has suggested that these pine species are sensitive to applications of methsulfuron methyl. Sulfonylureas (sulfometuron and metsulfuron) are more available for uptake and persist longer in high pH (7.0±) soils, thus lower application rates are recommended on these sites. Extended herbicide persistence in soil may lead to reduced growth or mortality of susceptible tree species.

Site Preparation Tank Mix #3:

Herbicide in Tank Mix	Herbicide Trade Name	Application Rate/Acre		Application Timing	Adjuvants
		Formulation	Active Ingredient		
Imazapyr	Arsenal AC®, Polaris AC®, Imazapyr 4SL®	16 – 32 oz. Max rate of 16 oz. for pine species other than loblolly	0.5 – 1 lb (acid equivalent)	August – October if combined with the latter two herbicides	Methylated Seed Oil (1 – 2.5%) after mid-July Or Non-ionic Surfactant (0.5 – 1%) before mid-July
	Chopper Gen2®, Polaris SP®, Rotary 2SL®	32 – 64 oz Max rate of 32oz. for pine species other than loblolly			
Glyphosate	Accord XRT®, Accord SP®, Razor Pro®	3 – 6 qts	3.8 – 7.6 lbs ai 4 – 8.1 lbs ai 4 – 6 lbs ai		
Saflufenacil	Detail®	2 oz	0.045 oz ai		

Comments: Aerial applications should deliver a volume of 10 – 15 gallons per acre; ground applied treatments conducted at 25 gallons per acre. In situations where majority of the targeted vegetation are non-waxy-leaved species, glyphosate may be substituted for triclopyr herbicides. Sulfufenacil can be added to improve “volunteer” or naturally regenerated pine reproduction.

Site Preparation Tank Mix #4:

Herbicide in Tank Mix	Herbicide Trade Name	Application Rate/Acre		Application Timing	Adjuvants
		Formulation	Active Ingredient		
Hexazinone	Velossa®	3.33 – 8.33 qts	2 – 5 lbs ai	Early growing season (April – May) Late summer (after July 15 th), after leaf expansion	Non-ionic Surfactant (0.5 – 1%) before mid-July
	Velpar L VU®	4 – 10 qts			
Sulfometuron methyl	Oust XP®, SFM 75®, Spyder®	2 – 8 oz	1.5 – 6 oz ai		
Metsulfuron methyl	Escort XP®, MSM 60®	1 – 2 oz	0.6 – 1.2 oz ai		
Oust Extra® (combined sulfometuron & metsulfuron) can be substituted and applied at 3 – 4 oz per acre					

Comments: This mixture is optimal if applied in the onset of spring (April) for soils with significant sand content. In the event that a fall site preparation treatment was not applied, this tank mix solution may be an acceptable substitute for chemical control of competing plants.

Site Preparation Tank Mix #5:

Herbicide in Tank Mix	Herbicide Trade Name	Application Rate/Acre		Application Timing	Adjuvants
		Formulation	Active Ingredient		
Picloram	Tordon K®, Triumph 22K®	1.5 – 2 qts	0.75 – 1 lb (acid equivalent)	Early growing season (May - June)	Non-ionic Surfactant (0.5 – 1%)
	Tordon 101®, Graslan L®	6 – 8 qts	3 – 4 lbs (acid equivalent)		
Picloram is compatible and can be tank mixed with any of the following (or multiple combination thereof):					
Glyphosate	Accord XRT®, Accord SP®, Razor Pro®	3 – 6 qts	3.8 – 7.6 lbs ai 4 – 8.1 lbs ai 4 – 6 lbs ai		
Triclopyr	Triclopyr 4®, Garlon 4 Ultra®, Tahoe 4E®	2 – 4 qts	2 – 4 lbs (acid equivalent)		

Comments: Avoid applying picloram in areas with low water tables or standing ground surface water as this is a restricted use herbicide. Allow at least six months of time between spraying and tree planting to avoid damage to planting stock.

Site Preparation Tank Mix #6:

Herbicide in Tank Mix	Herbicide Trade Name	Application Rate/Acre		Application Timing	Adjuvants
		Formulation	Active Ingredient		
Aminopyralid	Milestone®	4 – 7 oz	0.63 – 0.11 lbs (acid equivalent)	Early growing season (April – May)	Non-ionic Surfactant (0.5 – 1%) before mid-July
Aminopyralid is compatible and can be tank mixed with any of the following (or multiple combination thereof):					
Glyphosate	Accord XRT II®, Accord SP®, Razor Pro®	3 – 6 qts	3.8 – 7.6 lbs ai 4 – 8.1 lbs ai 4 – 6 lbs ai		
Imazapyr	Arsenal AC®, Polaris AC®, Imazapyr 4SL®	16 – 24 oz. Max rate of 16 oz. for pine species other than loblolly	0.5 - .75 lbs (acid equivalent)		
Triclopyr	Triclopyr 4®, Garlon 4 Ultra®, Tahoe 4E®	1 – 2 qts	1 – 2 lbs (acid equivalent)		

Comments: Aminopyralid has lesser residual soil activity and herbaceous plant competition will likely occur sooner in the subsequent growing season after treatment compared to tank mixtures containing more soil active herbicides.

Pre-mixed Herbicides:

The following are commercial herbicides sold as pre-mixed formulations containing individual active ingredients. These formulated herbicides can be substituted for individual herbicides at label specified rates. Some pine species such as slash and longleaf are sensitive to higher rates or individual herbicides such as metsulfuron methyl.

Formulated Herbicide Trade Name	Active Ingredients	Label Application Rate (Site Prep)
Capstone®	Aminopyralid & Triclopyr (amine)	6 - 9 pints per acre
Chapparal® Opensight®	Aminopyralid & Metsulfuron methyl	Forestry site preparation not mentioned on label
Lineage Clearstand®	Imazapyr & Metsulfuron methyl	Up to 25 oz per acre
Lineage Prep®	Imazapyr & Sulfometuron methyl & Metsulfuron methyl	10 - 15 oz per acre
Oust Extra® Spyder Extra® SFM Extra®	Sulfometuron methyl & Metsulfuron methyl	3 - 4 oz per acre
One Step® Prep-It®	Imazapyr & Glyphosate	1 - 2 gallons per acre

WEED CONTROL IN GRAIN SORGHUM

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>dicamba</i> Clarity/Banvel 4 S	8.0	0.25 lb	4	---	24 hours
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Comments: Apply CLARITY/BANVEL at least 15 days prior to planting grain sorghum.

<i>glyphosate</i> (various)	22-32 oz	0.75-1.13 lb ae	9	7 days	4 hours
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Comments: Apply in 10-20 gal of water 2 to 4 weeks prior to your anticipated planting date to control existing groundcover. Consult product label to determine if a non-ionic surfactant is needed.

<i>paraquat</i> 2S	2.0-4.0 pt	0.5-1.0 lb	22	---	12 hours
<i>paraquat</i> 3S	1.3-2.7 pt				

Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Better control of chickweed, henbit, deadnettle and cutleaf evening primrose than GLYPHOSATE alone. Add NIS at 1 qt/100 gal of spray mix.

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Grain Sorghum¹

	Glyphosate ²	Glyphosate + 2,4-D ²	Glyphosate + Atrazine ²	Glyphosate + Dicamba ²	Paraquat ²	Paraquat + 2,4-D ²	Paraquat + Dicamba ²
barley, little	E	E	E	E	G	G	G
bluegrass, annual	F	F	E	F	G	G	G
buttercups	E	E	E	E	E	E	E
chickweed, common	F	G	E	GE	E	E	GE
clovers	PF	F	F	FG	G	G	GE
cudweed	E	E	E	E	FG	FG	FG
dandelion	P	E	GE	E	N	E	GE
dock, curly	PF	G	G	GE	F	FG	GE
eveningprimrose, cutleaf	PF	E	E	GE	F	E	GE
geranium, Carolina	FG	E	E	E	GE	E	GE
henbit/deadnettle	F	G	E	GE	G	GE	E
horseweed (marestail)	E	GE	E	E	F	GE	E
mustard, wild	FG	E	GE	G	FG	E	G
pansy, field	F	F	GE	F	G	G	G
peanut, volunteer	F	F	F	G	P	F	GE
pepperweed, Virginia	G	E	GE	GE	G	GE	G
radish, wild	FG	GE	GE	GE	G	GE	GE
ryegrass, Italian	G	F	GE	F	FG	FG	FG
sorrel, red	E	E	E	E	E	E	E
spurry, corn	GE	GE	GE	GE	FG	G	G
swinecress	FG	G	G	G	PF	FG	FG
vetch	F	E	E	E	G	GE	GE
wheat/rye cover crop	E	E	E	E	FG	F	F

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Herbicide rates for burndown: Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ai/gal); 2,4-D at 1-2 pt/A; Dicamba at 8 oz/A; and Paraquat at 3.0 pt/A.

Important Ground and Surface Water Considerations Regarding the Use of Atrazine and Simazine Containing Herbicide Products.

ATRAZINE and SIMAZINE users are strongly encouraged to follow label guidelines, discussed below, to share in the responsibility of preserving the future use of ATRAZINE and SIMAZINE. These restrictions apply to all formulations of ATRAZINE and SIMAZINE, and all pre-mix package products that contain ATRAZINE and SIMAZINE.

Application Rate Restrictions: For soils that are not defined as highly erodible, the maximum use rate for ATRAZINE is 2.0 lb ai (active ingredient) per acre and for SIMAZINE is 2.0 lb ai per acre per season. For soils classified as highly erodible (as defined by NRCS), If conservation tillage is practiced with at least 30 percent crop residue coverage at planting, the maximum use rate is 2.0 lb ai per acre for ATRAZINE and SIMAZINE. If crop residue coverage is less than 30 percent, then the maximum rate for ATRAZINE and SIMAZINE is 1.6 lb ai per acre. If ATRAZINE **was not** applied prior to grain sorghum emergence, then the total amount applied should not exceed 2.0 lb ai per acre. If ATRAZINE was applied to a field preemergence, then the total amount of ATRAZINE **should not** exceed 2.5 lb ai per acre per calendar year. The total amount of SIMAZINE **should not** exceed 2.0 lb ai per acre per calendar year.

Setbacks: Operations that involve mixing, loading, rinsing, or washing ATRAZINE or SIMAZINE within 50 feet of wells (including abandoned wells, drainage wells, or sink holes), rivers, intermittent streams, lakes, or reservoirs is prohibited. This restriction does not apply to operations within a properly designed impervious pads and diked mixing/loading areas. ATRAZINE or SIMAZINE must not be applied aerially or by ground equipment within 66 feet of points where field surface water enters perennial or intermittent streams and rivers or within 200 feet around natural or impounded lakes and reservoirs. If ATRAZINE or SIMAZINE is applied to highly erodible land, the 66-foot buffer or setback from runoff entry points must be planted to crop, seeded with grass, or other suitable crop.

If ATRAZINE or SIMAZINE is applied to tile-terraced fields containing standpipes, then users are advised to follow one the following restrictions: 1) do not apply ATRAZINE or SIMAZINE within 66 feet of standpipes; 2) After applying ATRAZINE or SIMAZINE to the entire field, immediately incorporate it to a depth of 2-3 inches; or 3) Apply ATRAZINE or SIMAZINE to the entire field under conservation tillage practices where high crop residue levels are present.

Examples of Herbicide Products that Contain Atrazine or Simazine

Trade Name	Active Ingredient(s)	Trade Name	Active Ingredient(s)
Aatrex	<i>atrazine</i>	Harness Xtra	<i>acetochlor + atrazine</i>
Bicep II Magnum	<i>atrazine + s-metolachlor</i>	Guardzman MAX	<i>dimethenamid-p + atrazine</i>
Bicep Lite II Magnum	<i>atrazine + s-metolachlor</i>	Keystone	<i>acetochlor + atrazine</i>
Bullet	<i>alachlor + atrazine</i>	Lariat	<i>alachlor + atrazine</i>
Cinch ATZ	<i>s-metolachlor + atrazine</i>	Lumax	<i>s-metolachlor + atrazine + mestriene</i>
Degree Xtra	<i>acetochlor + atrazine</i>	Marksman	<i>dicamba + atrazine</i>
Expert	<i>glyphosate + s-metolachlor + atrazine</i>	Princep	<i>simazine</i>
Fultime	<i>acetochlor + atrazine</i>	Steadfast ATZ	<i>nicosulfuron + rimsulfuron + atrazine</i>

Preemergence Herbicides for Weed Management in Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i> Warrant 3.0 ME	1.5-2.25 qt	1.125-1.69 lb	15	---	12 hours
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Comments: Apply WARRANT after sorghum planting but before weeds germinate. Provides residual control of small-seeded broadleaves and grasses. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Do not apply ACETOCHLOR within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Use only on sorghum seed treated with a seed safener.

<i>acetochlor</i> +		1.35-1.69 lb	15	60 days	12 hours
<i>atrazine</i> FullTime NXT 4.04 SC	2.0-2.5 qt	0.67-0.84 lb	5		

Comments: FULTIME NXT is a RESTRICTED USE PESTICIDE. Application rate is based on organic matter content of the soil: For soils with less than 1.5% organic matter, application rate range is 2.0-2.5 qt/A (If %OM is higher than 1.5%, then rate can be higher, check label for more information). Use only on sorghum seed treated with a safener. Do not apply FULTIME to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year.

<i>atrazine</i> Aatrex 4WDL Aatrex Nine-O 90WDG	1.0-2.0 qt 1.1-2.2 lb	1.0-2.0 lb	5	60 days	12 hours
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Comments: ATRAZINE is a RESTRICTED USE PESTICIDE. Use to control most broadleaf weeds and a few grasses. Tank mix with a grass herbicide for broader spectrum control.

<i>dimethenamid-p</i> Outlook 6 EC	10-16 oz	0.47-0.75 lb	15	40 days	12 hours
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Comments: Controls most annual grasses (*except Texas Panicum*) and some broadleaf weeds. DIMETHENAMID-P may be tank-mixed with ATRAZINE. Use only on sorghum seed treated with a seed safener.

<i>s-metolachlor</i> Dual Mag.7.62 EC Dual II Mag. 7.64 EC Cinch 7.64 EC	1.0-1.33 pt	0.95-1.27 lb	15	90 days	24 hours
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Comments: Controls most annual grasses and some broadleaf weeds. Fair to good control of yellow nutsedge. S-METOLACHLOR may be tank mixed with ATRAZINE. Generic formulations of S-METOLACHLOR are also available. Use only on sorghum seed treated with a seed safener.

Postemergence Herbicides for Weed Management in Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i>		1.13-1.69 lb	15	60 days	12 hours
Warrant 3.0ME	1.5-2.25 qt				

Comments: Apply WARRANT over-the-top to sorghum from seedling emergence until sorghum reaches 11 inches in height. Weeds emerged at time of application will not be controlled by WARRANT. If weeds are emerged at time of application, tank mix a labeled postemergence corn herbicide with WARRANT. Do not make a postemergence surface application using a sprayable fluid fertilizer as the carrier because severe crop injury may occur. Do not exceed 4 qt per acre per season when making a second application of WARRANT. Tank mix partners include 2,4-D, ATRAZINE, AIM, DICAMBA, and MARKSMAN.

<i>acetochlor</i>		1.35-1.69 lb	15	60 days	12 hours
+					
<i>atrazine</i>		0.67-0.84 lb	5		
FulTime NXT 4.04 SC	2.0-2.5 qt				

Comments: FULTIME NXT is a RESTRICTED USE PESTICIDE. Apply FULTIME NXT before grain sorghum exceeds 11 inches in height (generally 5-6 lf stage). Application rate is based on organic matter content of the soil: For soils with less than 1.5% organic matter, application rate range is 2.0-2.5 qt/A (If %OM is higher than 1.5%, then rate can be higher, check label for more information). Use only on sorghum treated with a seed protectant. Do not apply FULTIME NXT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. Do not apply more than 3 lb ai ACETOCHLOR per acre per year.

<i>atrazine</i>		1.0-2.0 lb	5	None	12 hours
Aatrex 4WDL	1.0-2.0 qt				

Comments: Apply ATRAZINE before weeds exceed 3 inches in height and before grain sorghum exceed 12 inches in height. Add COC at 1 qt/A or emulsifiable oil at 1 gal/A. If ATRAZINE was not applied prior to grain sorghum emergence, apply a maximum of 2.0 lbs ai/A. If a postemergence treatment is required following an earlier preemergence application, total ATRAZINE applied cannot exceed 2.5 lbs ai/acre per calendar year. **Rainfast interval = not indicated on label (suggest 1 hour minimum).**

<i>bentazon</i>	1.5-2.0 pt	0.75-1.0 lb	6	12 days	48 hours
Basagran 4S					

Comments: Apply BASAGRAN to control most broadleaf weeds less than 4 inches tall. Do not apply more than 2 pt/A of BASAGRAN per season. Do not apply after heading or blooming stage in sorghum. **Rainfast interval = 4 hours.**

<i>bromoxynil</i>		0.25-0.375 lb	6	45 days	24 hours
Maestro 2EC	1.0-1.5 pt				
Maestro 4EC	0.5-0.75 pt				

Comments: Apply MAESTRO from the 3-leaf growth stage up to the preboot growth stage to control small broadleaf weeds. Less drift potential than BANVEL or 2,4-D. Use 10 or more gallons of water per acre. **Rainfast interval = not indicated on label (suggest 1 hour minimum).**

Postemergence Herbicides for Weed Management in Grain Sorghum (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i> Aim 2EC	0.5-1.0 fl oz	0.008-0.025 lb	14	3 days	12 hours
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Comments: Apply AIM up through the 6-leaf growth stage of sorghum to control small pigweed and annual morningglory. Excellent on large velvetleaf. Temporary leaf burn may occur. Add NIS at 1 qt/100 gal of spray mix. May be tank mixed with ATRAZINE, BANVEL, or CLARITY. Do not tank mix with AIM with a COC as crop injury may occur. Do not apply more than a total of 1.0 oz/A per season. **Rainfast interval = 6 hours.**

<i>dicamba</i> Banvel/Clarity 4S	0.5-1.0 pt	0.25-0.5 lb	4	24 hours	24 hours
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Comments: Apply BANVEL from emergence to 8 inches tall. Use drop nozzles to apply to row middles and prevent spraying into the crop whorl when sorghum is 8 to 15 inches tall. Use caution to prevent drift and injury to nearby sensitive crops. **Rainfast interval = not indicated on label (suggest 1 hour).**

<i>dicamba</i> +		0.28 lb	4	60 days	24 hours
<i>atrazine</i> Marksman 3.2S	2.0 pt	0.53 lb	5		

Comments: MARKSMAN is a RESTRICTED USE PESTICIDE. Apply MARKSMAN overtop grain sorghum from the 2- to 5-leaf stage of growth. For best result, apply at the 2- to 3-leaf stage of growth. All applications must be made before grain sorghum reaches 12" in height. Applications during periods of rapid growth may result in temporary leaning of the plants or rolling of leaves. These effects are usually outgrown within 10 to 14 days. On coarse textured soils, heavy rain immediately after application may cause sorghum injury. Do not use COC or NIS as crop injury may result. **Rainfast interval = 4 hours.**

<i>pro sulfuron</i> Peak 57WDG	0.75-1.0 oz	0.027-0.036 lb	2	30 days	12 hours
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Comments: Apply PEAK to grain sorghum from 5- to 30-inches in height and prior to head emergence. For best results, time application to optimum weed size rather than crop height. Use drop nozzles is sorghum is over 20-inches. Add NIS at 1 qt per 100 gal or COC at 1 qt per acre. Do not make a foliar or soil application of any organophosphate insecticide within 15 days before or 10 days after an application of PEAK. **Rainfast interval = 4 hours.**

<i>pyrasulfotole</i> +		0.031-0.039 lb	27	7 days	24 hours
<i>bromoxynil</i> Huskie 2.06EC	13-16 fl oz	0.18-0.22 lb	6		

Comments: HUSKIE is a RESTRICTED USE PESTICIDE. Apply HUSKIE from 3-leaf growth stage up to 12 inches in height. Treat broadleaves when small and actively growing. Do not apply more than 16 fl oz/A per application. Do not apply more than 2 applications of HUSKIE with a season maximum of 32 fl oz/A. Wait a minimum of 11 days between HUSKIE applications. Do not use air induction or flood jet nozzles to apply HUSKIE. Add ammonium sulfate at 1 lb/A if applied under challenging environmental conditions.

2,4-D amine (various)	0.5-1.5 pt	0.25-0.5 lb	4	30 days	48 hours
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Apply 2,4-D broadcast overtop grain sorghum that is 6 to 15 inches tall to control most broadleaf weeds. Use drop nozzles if sorghum is more than 8 inches in height. Use caution to prevent drift and injury to nearby sensitive crops. **Rainfast interval = not indicated on label (suggest 1 hour minimum).**

Postemergence Directed Herbicides for Weed Management in Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i> Aim 2EC	1.0 fl oz	0.008 lb	14	3 days	12 hours
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Comments: Apply AIM as a postemergence directed spray from V8 to V14 growth stage. Add NIS at 1 qt per 100 gals of spray mixture. Avoid directing the spray in the whorl of the plant. Tank mix partners include ATRAZINE, 2,4-D AMINE, BANVEL, CLARITY, or PEAK. **Rainfast interval = 6 hours.**

<i>dicamba</i> Banvel/Clarity 4S	0.5-1.0 pt	0.25-0.5 lb	4	24 hours	24 hours
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Comments: Apply BANVEL using directed nozzles after sorghum reaches 8 inches tall. Use care to keep the spray from contacting the sorghum leaves or crop whorl. This will reduce the likelihood of crop injury. Do not apply after sorghum is 15 inches in height. *Use caution to prevent drift and injury to nearby sensitive crops.* **Rainfast interval = not indicated on label (suggest 1 hour).**

<i>linuron</i> Linex 4L Lorox 50DF	1.0-1.5 pt 1.0-2.0 lb	0.25-0.75 lb 0.5-1.0 lb	7	75 days	24 hours
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Comments: Apply LINEX or LOROX as a postemergence directed spray when grain sorghum is at least 15 inches tall. For best results, apply when there is sufficient height differential between weeds and the crop so that the directed spray thoroughly covers all weed foliage without contact of upper leaves or whorl of the grain sorghum by spray or drift. Add NIS at a rate of 2 qt per 100 gals of spray mixture. Spray to cover weeds no more than 3 to 4 inches tall. Use lower rate when weeds are no taller than 2 inches and higher rate for weeds up to 4 inches tall. Non-pressure nitrogen solution may be substituted for all or part of the water carrier. **Rainfast interval = not indicated on label (suggest 1 hour minimum).**

<i>paraquat 2S</i> <i>paraquat 3S</i>	1.0-2.0 pt 0.7-1.3 pt	0.25-0.5 lb	22	48 days	12 hours
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Comments: Apply PARAQUAT as a postemergence directed spray when grain sorghum is at least 12 inches tall. A hooded or shielded sprayer is recommended to minimize spray contact with grain sorghum foliage. Apply in a minimum of 10 gallons of water per acre. Coverage is important for weed control performance. Weeds 6 inches or taller may not be controlled. Add NIS at a rate of 2 qt per 100 gals of spray mixture. If using drop nozzles, arrange nozzles to spray no higher than lower 3 inches of the stalks. Some foliage will be injured but crop will recover and develop normally. Do not exceed 2 postemergence directed applications or 4.0 pt/A per season of PARAQUAT. **Rainfast interval = 30 minutes.**

2,4-D amine (various)	0.75-1.5 pt	0.188-0.75 lb	4	30 days	48 hours
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Comments: Apply 2,4-D as a postemergence directed spray from 8 inches tall up to 15 inches tall using drop nozzles to minimize contact with grain sorghum plant. If grain sorghum plants are growing rapidly, reduce 2,4-D rate to 0.5 pt to minimize crop injury potential. *Use caution to prevent drift and injury to nearby sensitive crops.* **Rainfast interval = not indicated on label (suggest 1 hour).**

Harvest Aids for Grain Sorghum

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i> Aim 2EC	1.0 fl oz	0.016 lb	14	3 days	12 hours
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Comments: Apply AIM after crop is physiologically mature and grain has begun to dry down (black layer has formed). Desiccates annual morningglory and other harvest impediments. Add a COC at 1-2 gal/100 gals, NIS at 1 qt/100 gals, or MSO at 1-2 gal/100 gals to the spray mix. Apply AIM in a minimum of 10 gal/A spray volume. **Rainfast interval = 6 hours.**

<i>glyphosate</i> (various)	22-44 fl oz	0.75-1.5 lb ae	9	7 days	12 hours
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Comments: Apply after sorghum is physiologically mature and has reached 30 percent grain moisture or less. Do not use glyphosate if grain sorghum is infected with characoal rot as lodging may occur. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Weed Response to Herbicides for Grain Sorghum Weed Management¹

	PRE			POSTEMERGENCE							POST-DIRECTED				
	Atrazine	Dimethenamid-p ²	S-Metolachlor ²	Atrazine	Aim	Basagran	Dicamba	Maestro	Marksman	2,4-D	Aim	Dicamba	Linuron	Paraquat	2,4-D
anoda, spurred	GE	---	---	GE	P	P	GE	---	GE	G	P	GE	---	GE	G
barnyardgrass	GE	E	G	GE	P	G	P	P	P	P	P	P	E	G	P
beggarweed, Florida	E	P	F	G	F	P	G	G	FG	P	G	G	E	E	P
bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P	P	PF	P
citronmelon	G	P	P	G	FG	P	E	G	G	E	P	G	E	F	E
cocklebur, common	E	P	P	E	P	P	E	---	E	G	P	E	GE	GE	G
cowpea	E	P	P	E	FG	P	E	FG	E	E	---	E	G	G	E
crabgrass	F	E	E	G	P	P	P	P	P	P	P	P	GE	GE	P
crotalaria, showy	GE	P	P	GE	F	P	G	G	G	G	G	G	E	G	G
croton, tropic	GE	P	P	G	G	E	GE	E	GE	E	G	E	E	GE	E
crowfootgrass	P	E	E	G	P	P	P	P	P	P	P	P	GE	GE	P
dayflower, Benghal	F	GE	GE	GE	---	P	GE	---	---	GE	---	GE	GE	GE	GE
eclipta	GE	---	---	GE	FG	FG	G	G	G	G	FG	G	G	FG	G
goosegrass	P	E	E	G	P	P	P	P	P	P	P	P	G	GE	P
jimsonweed	E	P	P	E	GE	E	E	E	E	E	GE	E	E	GE	E
johnsongrass, seedling	P	P	F	F	P	P	P	P	P	P	P	P	G	GE	P
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
lambsquarters, common	E	G	G	E	GE	FG	E	E	E	E	G	E	E	G	E
morningglory, annual	GE	P	P	G	G	P	E	G	E	E	G	E	E	G	E
nutsedge, purple	P	F	FG	P	P	P	P	P	F	P	P	P	P	FG	P
nutsedge, yellow	P	G	G	PF	P	G	P	P	F	P	P	P	F	FG	P
panicum, fall	PF	GE	E	G	P	P	P	P	P	P	P	P	GE	GE	P
panicum, Texas	P	PF	PF	F	P	P	P	P	P	P	P	P	G	GE	P
pigweed spp.	E	E	G	E	G	P	E	F	GE	E	G	E	E	GE	E
poinsettia, wild	GE	P	P	GE	---	P	GE	PF	E	GE	---	GE	GE	G	GE
purslane, common	E	G	G	E	G	P	E	---	---	G	G	E	G	G	G
pusley, Florida	E	GE	GE	G	FG	P	G	E	E	G	FG	E	G	GE	G
ragweed, common	E	F	PF	GE	FG	G	E	E	E	E	P	E	E	G	E
sandbur, field	F	G	G	F	P	P	P	P	P	P	P	P	E	FG	P
senna, coffee	F	P	P	FG	P	P	E	F	GE	GE	P	E	GE	GE	GE
sesbania, hemp	FG	P	P	FG	F	P	E	G	GE	G	F	E	G	PF	G
sicklepod	GE	P	P	G	P	P	GE	P	GE	G	P	E	GE	G	G
sida, prickly	E	P	P	GE	FG	G	G	F	E	G	G	E	GE	FG	G
signalgrass, broadleaf	PF	GE	GE	F	P	P	P	P	P	P	P	P	GE	GE	P
smartweed, Pennsylvania	GE	P	P	G	FG	E	E	GE	E	F	G	E	GE	GE	F
spurge	GE	---	---	GE	FG	F	G	GE	GE	G	F	E	G	FG	G
starbur, Bristly	GE	P	P	E	---	E	E	F	GE	GE	E	GE	GE	G	GE
velvetleaf	FG	P	P	G	F	GE	GE	GE	E	G	E	G	G	P	G

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70% control; --- = Insufficient Data.

²Use only on sorghum hybrids treated with a safener.

GRAIN SORGHUM INSECT CONTROL

Francis P. F. Reay-Jones, Extension Entomologist

A new pest of sorghum, the **sugarcane aphid** (*Melanaphis sacchari*) was found for the first time in South Carolina in October 2014. This invasive species was first detected in the continental United States in Florida in 1977 and in Louisiana in 1999 on sugarcane where it remains a minor pest.



The insect switched hosts in 2013 and was found on grain and forage sorghum in Texas. This new strain or biotype was also found in 2013 in Mississippi, Louisiana, and Oklahoma, and it rapidly spread in 2014 to Arkansas, Tennessee, Alabama, Georgia, and South Carolina. While it is unknown if the aphid can successfully overwinter in South Carolina, the insect has since successfully infested sorghum each year in South Carolina, in addition to spreading to many new states. The dark cornicles (tail pipes) and dark tarsi (feet) differentiate this species from the other main pest species of aphids in sorghum.

The sugarcane aphid feeds on plant sap and can seriously injure or even kill plants. While feeding, aphids secrete a sticky substance called honeydew which can cover plants and lead to problems with harvesting. Infestations of sugarcane aphids have been severe enough in some fields in South Carolina to cause complete crop failure, though on average, yield losses are less across the state. Research trials at the Pee Dee and Edisto RECs have focused on assessing the impact of this pest on sorghum in South Carolina and providing management recommendations.



Labeled products for control of aphids on sorghum include dimethoate, but, this product often only provide fair control, and pre-harvest intervals are lengthy (28 days at the lowest rate). Data from trials in South Carolina indicate that dimethoate provides poor levels of control. Pyrethroids will flare populations of aphids by reducing numbers of their natural enemies, so they should not be used when sugarcane aphids are present. The insecticide Sivanto (flupyradifurone) is labeled on sorghum in South Carolina. Under FIFRA section 2(ee), a reduced rate (4-7 oz of product per acre) of Sivanto is available for control of sugarcane aphid on sorghum. This insecticide provided very good levels of control in our trials. Since 2019, Transform (sulfoxaflor) has a full label in grain sorghum in South Carolina, and also provides good control of sugarcane aphids. Sefina (afidopyropen), a new insecticide from a novel class of insecticide, was recently granted a supplemental label for use for aphids in sorghum.


Because sugarcane aphids can build up rapidly, sorghum fields should be scouted at least once a week, preferably twice a week. An economic threshold of 50 aphids per leaf is recommended.

Several grain sorghum hybrids have levels of tolerance to sugarcane aphid feeding relative to susceptible standard hybrids. An important consideration is that the value of using tolerant hybrids will only be apparent under moderate to heavy aphid pressure. Yield potential should be a primary factor when choosing hybrids. Even tolerant hybrids will need an application of insecticide under moderate to heavy pressure.


INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Aphids (seed insecticide) 	Clothianidin PONCHO 600	5.1-6.4 fl oz /100 lb of seed	-	-	-	Seed treatment
	Imidacloprid GAUCHO 600	6.4fl oz/100 lb of seed	12	45	45	Seed treatment
	Thiomethoxam CRUISER 5FS	5.1-7.6 fl oz / 100 lb of seed	12	-	-	Seed treatment
Aphids (post-emergence insecticides) (all species <u>except sugarcane aphid</u>)	Dimethoate DIMETHOATE 4E	0.5-1 pt/ac	48	28	28	Use 25-40 gal of water per acre for ground application.
	DIMETHOATE 400	0.5-1.5 pt/ac	48	28	28	
Sugarcane Aphid	Afidopyropen SEFINA	6.0 oz/ac	12	14	7	
	Flupyradifurone SIVANTO PRIME	4-7 oz/ac	4	7	21	Use at least 10 gallons/ac for ground applications.
	Sulfoxaflor TRANSFORM	0.75-1.5 oz/ac	24	14	7	
Armyworms (post-emergence insecticides) 	Beta-cyfluthrin BAYTHROID XL R	1.3-2.8 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb/ac	12	21	14	
	4F, XLR Plus	1-2 qts/ac	12	21	14	

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.


INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Armyworms (post-emergence insecticides) (cont.) 	Chlorantraniliprole PREVATHON	14-20 oz/ac	4	1	1	
	Deltamethrin DELTA GOLD 1.5EC R	1.3-1.9 oz/ac	12	14	14	For ground application, use at least 5 gal/ac of water.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	30	30	
	PROLEX R	1.02-1.54 oz/ac	24	30	30	
	Lambda-cyhalothrin KARATE Z R	1.28-1.92	24	30	30	Use higher rates for large larvae.
	WARRIOR R	2.56-3.84 oz/ac	24	30	30	
	Methomyl LANNATE LV R	0.75-1.5 pts/ac	48	14	14	Use at least 10 gal. of water per acre for ground application.
	LANNATE SP R	0.25-0.5 lbs/ac	48	14	14	
Spinosad BLACKHAWK	1.7-3.3 oz/ac	4	7	14	Apply at peak egg hatch of each generation.	
Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz/ac	12	14	45	Use at least 10 gal. of water per acre for ground application.	
Chinch bug (seed insecticide) 	Clothianidin PONCHO 600	5.1-6.4 fl oz /100 lb of seed	-	-	-	Seed treatment
	Imidacloprid GAUCHO 600	6.4fl oz/100 lb of seed	12	45	45	Seed treatment
	Thiomethoxam CRUISER 5FS	5.1-7.6 fl oz / 100 lb of seed	12	-	-	Seed treatment
Chinch bug (post-emergence insecticides)	Beta-cyfluthrin BAYTHROID XL R	2-2.8 oz/ac	12	14	14	Beta-cyfluthrin BAYTHROID XL R
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.25-2.5 lb/ac 1-2 qts/ac	12 12	21 21	14 14	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus
R=Restricted use pesticide; REI=re-entry interval (hrs); PHI=pre-harvest interval (days); PGI=pre-grazing interval (days).						

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Chinch bug (post-emergence insecticides) (cont.)	Deltamethrin DELTA GOLD 1.5EC R	1.3-1.9 oz/ac	12	14	14	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz/ac	12	21	21	Spray at base of plant for best results.
	Gamma-cyhalothrin PROAXIS R	3.84 oz/ac	24	30	30	Apply directed toward based of plant when insect move from small grains or grass weeds to sorghum.
	PROLEX R	1.54 oz/ac	24	30	30	
	Lambda-cyhalothrin KARATE Z R	1.92	24	30	30	Apply directed toward based of plant when insect move from small grains or grass weeds to sorghum.
WARRIOR R	3.84 oz/ac	24	30	30		
Corn earworm (post-emergence insecticides) 	Beta-cyfluthrin BAYTHROID XL R	1.3-2.8 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb/ac	12	21	14	
	4F, XLR Plus	1-2 qts/ac	12	21	14	
	Chlorantraniliprole PREVATHON	14-20 oz/ac	4	1	1	
	Deltamethrin DELTA GOLD 1.5EC R	1.0-1.5 oz/ac	12	14	14	For ground application, use at least 5 gal/ac of water.
	Esfenvalerate ASANA XL R	5.8-9.6 oz/ac	12	21	21	Esfenvalerate ASANA XL R
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	30	30	Gamma-cyhalothrin PROAXIS R
	PROLEX R	1.02-1.54 oz/ac	24	30	30	PROLEX R
Lambda-cyhalothrin KARATE Z R	1.28-1.92	24	30	30	Use higher rates for large larvae.	
WARRIOR R	2.56-3.84 oz/ac	24	30	30		


R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Corn earworm (post-emergence insecticides) (cont.)	Methomyl LANNATE LV R	0.75-1.5 pts/ac	48	14	14	Use at least 10 gal. of water per acre for ground application.
	LANNATE SP R	0.25-0.5 lbs/ac	48	14	14	
	Spinosad BLACKHAWK	1.7-3.3 oz/ac	4	7	14	Apply at peak egg hatch of each generation.
	Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz/ac	12	14	45	Use at least 10 gal. of water per acre for ground application.
Cutworm 	Beta-cyfluthrin BAYTHROID XL R	1-1.3 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	2.5 lb/ac 2 qts/ac	12 12	21 21	14 14	
	Deltamethrin DELTA GOLD 1.5EC R	1-1.5 oz/ac	12	14	14	For ground application, use at least 5 gal/ac.
	Esfenvalerate ASANA XL R	5.8-9.6 oz/ac	12	21	21	Spray at base of plant for best results.
	Gamma-cyhalothrin PROAXIS R	1.92-2.56 oz/ac	24	30	30	Apply directed toward based of plant when insect move from small grains or grass weeds to sorghum.
	PROLEX R	0.77-1.02 oz/ac	24	30	30	
	Lambda-cyhalothrin KARATE Z R	0.96-1.28	24	30	30	Apply directed toward based of plant when insect move from small grains or grass weeds to sorghum.
	WARRIOR R	1.92-2.56 oz/ac	24	30	30	
Zeta-cypermethrin MUSTANG MAX R	1.28-4.0 oz/ac	12	14	45		

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Sorghum midge (post-emergence insecticides) 	Beta-cyfluthrin BAYTHROID XL R	1.0-1.3 oz/ac	12	14	14	
	Deltamethrin DELTA GOLD 1.5EC R	1.3-1.9 oz/ac	12	14	14	For ground application, use at least 5 gal/ac.
	Dimethoate DIMETHOATE 4E	0.25-0.5 pt/ac	48	28	28	Use 25-40 gal of water per acre for ground application.
	Esfenvalerate ASANA XL R	2.9-5.8 oz/ac	12	21	21	
	Gamma-cyhalothrin PROAXIS R PROLEX R	1.92-2.56 oz/ac 0.77-1.02 oz/ac	24 24	30 30	30 30	Apply when 25% of heads have emerged and are in tip bloom.
	Lambda-cyhalothrin KARATE Z R WARRIOR R	0.96-1.28 1.92-2.56 oz/ac	24 24	30 30	30 30	Apply when 25% of heads have emerged and are in tip bloom.
	Methomyl LANNATE LV R LANNATE SP R	0.75-1.5 pts/ac 0.25-0.5 lbs/ac	48 48	14 14	14 14	Use at least 10 gal. of water per acre for ground application. Apply at 50% bloom.
Sorghum webworm (post-emergence insecticides)	Beta-cyfluthrin BAYTHROID XL R	1.3-2.8 oz/ac	12	14	14	
	Carbaryl SEVIN 80S, 80WSP 4F, XLR Plus	1.25-2.5 lb/ac 1-2 qts/ac	12 12	21 21	14 14	
	Deltamethrin DELTA GOLD 1.5EC R	1.0-1.5 oz/ac	12	14	14	For ground application, use at least 5 gal/ac.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	30	30	

R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.

INSECT	PESTICIDE AND FORMULATION	RATE	REI	PHI	PGI	COMMENTS
Sorghum webworm (post-emergence insecticides) (cont.)	Lambda-cyhalothrin KARATE Z R	1.28-1.92 oz/ac	24	30	30	
	WARRIOR R	2.56-3.84 oz/ac	24	30	30	
	Methomyl LANNATE LV R	1.5 pts/ac	48	14	14	Use at least 10 gal. of water per acre for ground application.
	LANNATE SP R	0.5 lbs/ac	48	14	14	
	Spinosad BLACKHAWK	1.7-3.3 oz/ac	4	7	14	Apply at peak egg hatch of each generation.
Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz/ac	12	14	45	Use at least 10 gal. of water per acre for ground application.	
Stink bugs (post-emergence insecticides) 	Beta-cyfluthrin BAYTHROID XL R	1.3-2.8 oz/ac	12	14	14	Beta-cyfluthrin BAYTHROID XL R
	Carbaryl SEVIN 80S, 80WSP	1.25-2.5 lb/ac	12	21	14	Carbaryl SEVIN 80S, 80WSP
	4F, XLR Plus	1-2 qts/ac	12	21	14	4F, XLR Plus
	Deltamethrin DELTA GOLD 1.5EC R	1.5-1.8 oz/ac	12	14	14	For ground application, use at least 5 gal/ac of water.
	Gamma-cyhalothrin PROAXIS R	2.56-3.84 oz/ac	24	30	30	
	PROLEX R	1.02-1.54 oz/ac	24	30	30	
	Lambda-cyhalothrin KARATE Z R	1.28-1.92 oz/ac	24	30	30	
WARRIOR R	2.56-3.84 oz/ac	24	30	30		
	Zeta-cypermethrin MUSTANG MAX R	1.76-4.0 oz/ac	12	14	45	Use at least 10 gal. of water per acre for ground application.
R = Restricted use pesticide; REI = re-entry interval; PHI = pre-harvest interval; PGI = pre-grazing interval.						

WEED CONTROL IN PEANUT

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				

<i>carfentrazone</i> Aim 2EC	1.0-2.0 fl oz	0.016-0.032 lb	14	3 days	12 hours	6-8 hours
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Comments: Apply *carfentrazone* any time before planting when weeds are 4 inches tall (less than 3 inch rosettes) or less. Use the higher rate for larger weed sizes. Add a COC (1-2 gal per 100 gals spray solution), NIS (1 qt per 100 gals spray solution), or MSO (1-2 gal per 100 gals of spray solution). Tank mix *carfentrazone* with 2,4-D for improved cutleaf eveningprimrose and wild radish/mustard control.

<i>flumioxazin</i> Valor SX 51WDG Valor EZ 4SC	1.0-3.0 oz 1.0-3.0 fl oz	0.032-0.096 lb	14	60 days	12 hours	--
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Comments: Apply up to 14 days prior to planting. Do not apply more than 3 oz/A of *flumioxazin* during a single growing season. Strip till shanks ahead of the planter incorporate the soil will result in reduced weed control in the furrow. Can be tank-mixed with other burndown herbicides to enhance speed of burndown (e.g., *glyphosate* or *paraquat*).

<i>Glyphosate 4.5SL</i>	22-32 fl oz	0.75-1.13 lb ae	9	7 days	4 hours	--
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Comments: Apply any time prior to planting to control emerged weeds. Refer to the specific product label for the weed spectrum, application rates, adjuvants, and precautions. *Glyphosate* alone does not provide acceptable levels of cutleaf evening primrose, wild radish/mustard, or Carolina geranium control. Tank mix with 2,4-D for enhanced control of these weeds. *Glyphosate* can also be tank-mixed with *flumioxazin* or *carfentrazone* to improve the spectrum of control and provide residual of weeds. Refer to specific comments for *flumioxazin*. Applications to wheat and rye should be made before the boot stage or after the wheat is fully headed.

<i>Glyphosate 4.5SL</i> +	22-32 fl oz +	0.75-1.13 lb ae +	9	7 days	48 hours	--
2,4-D amine (various)	1.0-2.0 pt	0.48-0.95 lb	4			

Comments: Apply 15 to 30 days before planting to control emerged weeds. Tank mixing 2,4-D with *glyphosate* improves control of large cutleaf eveningprimrose and wild radish/mustard. The waiting intervals prior to planting following application of 2,4-D are 15 to 30 days, depending on the rate.

<i>paraquat</i> (various) 2S 3S	40-60 fl oz 27-40 fl oz	0.625-0.94 lb	22	---	12 hours	30 min
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Comments: *Paraquat* is a RESTRICTED USE PESTICIDE. Apply any time before planting to control emerged weeds. Add NIS at 1 qt per 100 gals or COC at 1 gal per 100 gals of spray mixture. *Paraquat* will not control large horseweed, curly dock, cutleaf eveningprimrose, and wild radish/mustard in one application. Can also be tank-mixed with *flumioxazin* (1.0-3.0 oz/A) to improve the spectrum of control and provide residual weed control.

<i>pyraflufen ethyl</i> ET 0.208EC	0.5-2.0 fl oz	0.0008-0.0032 lb	14	7 days	12 hours	1 hour
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Comments: Apply *pyraflufen* any time before planting. Add a COC at 1-2% v/v (i.e., 1-2 gal/100 gals) to the spray mixture. Use the higher COC rate for larger weeds or drier conditions. Provides control of small Palmer amaranth, annual morningglory, sicklepod, and other small broadleaf weeds. Use a minimum of 5 gallons spray solution per acre by air or 10 gallons spray solution per acre by ground. Do not apply more than 2.0 fl oz per acre per growing season.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Preplant/Burndown Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
<i>rimsulfuron</i>		0.016 lb	2		12 hours	--
+		+				
<i>thifensulfuron</i>		0.016 lb	2			
Leadoff 33.4SG	1.5 oz					

Comments: Apply *rimsulfuron* + *thifensulfuron* any time after fall harvest through early spring (minimum of 45 days before planting). A three-way tank mixture of *glyphosate* + *2,4-D amine* + *rimsulfuron* + *thifensulfuron* provides burndown and/or residual control of Carolina geranium, cutleaf eveningprimrose, marestail, vetches, wild radish, wild mustard, ryegrass, and chickweed. If *glyphosate* does not contain a built-in surfactant, then add NIS at 1 qt per 100 gal or COC at 1 gal per 100 gal of spray solution plus an ammonium nitrogen liquid fertilizer (such as urea ammonium nitrate at 2 qt/A or ammonium sulfate at 2 lb/A).

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Peanut¹

	Aim/ET ²	Glyphosate ²	Glyphosate + 2,4-D ²	Glyphosate + 2,4-D + Leadoff ²	Glyphosate + Flumioxazin ²	Paraquat ²	Paraquat + Flumioxazin ²
barley, little	F	E	E	E	E	G	G
bluegrass, annual	G	F	F	E	E	G	G
buttercups	G	E	E	E	E	E	E
chickweed, common	G	F	G	E	E	E	E
clovers	P	PF	F	G	F	G	GE
cudweed	G	E	E	E	E	FG	FG
dandelion	P	P	E	E	G	P	P
dock, curly	P	PF	G	F	G	F	P
eveningprimrose, cutleaf	GE	PF	E	E	FG	F	GE
geranium, Carolina	GE	FG	E	E	E	GE	E
henbit/deadnettle	G	F	G	E	E	G	E
horseweed (marestail)	G	E	GE	GE	GE	F	GE
mustard, wild	G	FG	E	GE	GE	FG	GE
pansy, field	G	F	F	---	F	G	G
pepperweed, Virginia	G	G	E	E	G	G	G
radish, wild	G	FG	GE	GE	GE	G	GE
ryegrass, Italian	F	G	F	E	G	FG	FG
sorrel, red	F	E	E	G	E	E	E
spurry, corn	G	GE	GE	E	G	FG	G
swinecress	G	FG	G	E	FG	PF	G
vetch	GE	F	E	E	FG	G	GE
wheat/rye cover crop	P	E	E	E	E	FG	G

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Herbicide rates: ET at 1.0 oz/A; AIM at 1.0 oz/A; *glyphosate* at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ae/gal); *2,4-D* at 1-2 pt/A; *Leadoff* at 1.5 oz/A; *paraquat* at 2.0 pt/A; and *flumioxazin* at 3.0 oz/A.

General Herbicide Options for Weed Management in Peanut

Application Timing	Conventional Tillage		Conservation Tillage	
	Valor ¹ (non-Cadre)	Valor + Cadre	Valor ¹ (non-Cadre)	Valor + Cadre
Preplant Burndown	-----	-----	Glyphosate+2,4-D	Glyphosate+2,4-D
PPI	Prowl <i>or</i> Sonalan	Prowl <i>or</i> Sonalan	-----	-----
PRE	Valor + (Prowl, Dual, or Sonalan)	Valor + (Prowl, Dual, or Sonalan)	Valor + (Dual, Prowl, or Sonalan)	Valor + (Prowl, Dual or Sonalan)
Early POST (1st weed flush)	paraquat + Basagran/Storm + Dual or Warrant	paraquat + Basagran/Storm + Dual or Warrant	paraquat + Basagran/Storm + Dual or Warrant	paraquat + Basagran/Storm + Dual or Warrant
POST	Paraquat + Basagran/Storm ² + Dual or Warrant	Cadre ³ + Outlook or Warrant + 2,4-DB	Paraquat + Basagran/Storm ² + Warrant	Cadre ³ + Outlook or Warrant + 2,4-DB
Late weed escapes⁴	2,4-DB	2,4-DB	2,4-DB	2,4-DB
	Ultra Blazer/Cobra	Ultra Blazer/Cobra	Ultra Blazer/Cobra	Ultra Blazer/Cobra
Select/Poast/Fusilade (Grass escapes or late emerging grasses)				

¹CADRE-FREE herbicide programs for growers who prefer not to use CADRE due to rotational cotton injury concerns.

²Apply PARAQUAT + BASAGRAN or PARAQUAT + STORM up to 28 days after peanut emergence.

³Apply CADRE up to 30-35 days after peanut emergence.

⁴Please follow preharvest intervals for these treatments; consult respective herbicide labels for more details.

Management Options for ALS-Resistant Palmer Amaranth in Peanut¹

Palmer amaranth in South Carolina is resistant to several herbicide families including acetolactate synthase (ALS) inhibitors (i.e., Cadre, Classic, Strongarm), dinitroaniline (i.e., Prowl and Sonalan), and glyphosate (Roundup). The following table can assist growers in planning and implementing an herbicide program to mitigate or delay ALS-resistant Palmer amaranth in peanut.

Tillage	Preplant Burndown	Preemergence	1 st Weed Flush (~14d after Planting)	POST2 (by 28d after Planting)
Strip Tillage	Glyphosate or paraquat + 2,4-D	Valor ³	paraquat + Storm ³ + Dual, Outlook, or Warrant	2,4-DB + Cobra ³ <i>or</i> 2,4-DB + Ultra Blazer ³
		Valor ³ + Dual, Outlook, Warrant, Prowl	paraquat + Storm ³ + Outlook, Warrant, Zidua	2,4-DB + Cobra ³ <i>or</i> 2,4-DB + Ultra Blazer ³
Tillage	Preplant Incorporated ⁴	Preemergence	1 st Weed Flush (~14d after Planting)	POST2 (by 28d after Planting)
Conventional Tillage	Prowl or Sonalan	Valor ³	paraquat + Storm ³ + Dual, Outlook, or Warrant	2,4-DB + Cobra ³ <i>or</i> 2,4-DB + Ultra Blazer ³
	Prowl or Sonalan	Valor ³ + Dual, Outlook, Warrant	paraquat + Storm ³ + Outlook, Warrant, Zidua	2,4-DB + Cobra ³ <i>or</i> 2,4-DB + Ultra Blazer ³

¹ALS-resistant Palmer amaranth is prevalent in South Carolina. A program with overlapping soil residual in conjunction with postemergence herbicides with differing modes-of-action will be required for optimum season long management.

²CADRE and PURSUIT (ALS-inhibitors, MOA=2) can be tank mixed with COBRA or ULTRA BLAZER if control of other broadleaf weeds is needed. Because CADRE and PURSUIT are both ALS-inhibitors, these tank mixtures are preferred over CADRE or PURSUIT alone.

³VALOR, STORM, COBRA, and ULTRA BLAZER have the same mode of action (PPO inhibitor, MOA=14). Do not make more than 2 applications of these herbicides per year.

⁴Use DUAL MAGNUM or OUTLOOK instead of SONALAN or PROWL if DNA-resistant (MOA=3) Palmer amaranth is present in your fields.

Weed Response to Soil Applied Herbicides for Peanut Weed Management¹

	PPI ²		PPI ² /PRE ³					PRE ³			
	Sonalan	Dimethamid-p	Dual Magnum	Prowl	Pursuit	Strongarm	Solicam	Brake	Valor SX	Spartan Charge	Warrant
anoda, spurred	P	P	P	P	G	FG	GE	---	F	G	---
barnyardgrass	E	E	E	E	F	P	E	E	E	F	E
beggarweed, Florida	G	F	PF	P	P	FG	G	---	GE	G	F
bermudagrass	P	P	P	P	P	P	P	P	P	P	P
citronmelon	P	P	P	P	P	G	G	P	G	F	---
cocklebur, common	P	P	P	P	GE	GE	PF	P	P	FG	P
cowpea	P	P	P	P	P	P	G	P	PF	P	E
crabgrass	E	E	E	E	F	P	GE	E	P	F	E
crotalaria, showy	P	P	P	P	P	---	---	P	G	---	P
croton, tropic	P	P	P	P	P	FG	G	G	G	G	P
crowfootgrass	E	E	G	E	P	P	G	E	P	F	P
dayflower, Benghal	P	GE	GE	P	G	G	PF	---	F	---	GE
eclipta	P	PF	PF	P	P	GE	G	---	GE	G	G
goosegrass	E	E	E	E	F	P	G	E	P	F	E
jimsonweed	P	P	P	P	G	GE	FG	F	G	G	F
johnsongrass, seedling	E	F	F	E	G	P	GE	E	P	F	P
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P	P
lambsquarters, common	GE	FG	F	GE	F	GE	FG	E	GE	E	FG
morningglory, annual	P	P	P	P	G	FG	F	P	FG	E	P
nutsedge, purple	P	P	P	P	G	PF	P	P	P	G	P
nutsedge, yellow	P	F	FG	P	FG	PF	P	P	P	G	F
panicum, fall	E	G	G	E	PF	P	G	E	P	F	G
panicum, Texas	GE	P	P	GE	PF	PF	P	E	P	F	F
pigweed spp.	GE	GE	GE	G	E	E	GE	E	E	GE	GE
ALS-resistant	GE	GE	GE	G	P	P	GE	E	E	GE	GE
DNA-resistant	P	GE	GE	P	E	E	GE	E	E	GE	GE
poinsettia, wild	P	P	P	P	E	GE	P	---	---	G	G
purslane, common	GE	G	G	GE	G	---	GE	E	GE	F	G
pusley, Florida	E	G	G	E	G	GE	GE	E	GE	F	GE
ragweed, common	P	F	P	P	P	GE	G	F	GE	P	P
redweed	P	P	P	P	---	G	G	F	GE	G	---
ryegrass, annual	G	G	G	G	F	P	GE	E	GE	F	FG
sandbur, field	E	FG	G	E	---	P	F	E	P	F	FG
senna, coffee	P	P	P	P	FG	P	F	F	PF	G	P
sesbania, hemp	P	P	P	P	P	PF	P	F	G	G	P
sicklepod	P	P	P	P	P	P	F	F	P	P	P
sida, prickly	P	P	F	P	GE	FG	GE	G	GE	G	G
signalgrass, broadleaf	G	FG	FG	G	P	P	G	E	P	F	FG
smartweed, Pennsylvania	P	P	P	P	G	G	G	F	PF	E	P
spurge	P	PF	PF	P	---	---	GE	G	GE	G	G
starbur, bristly	P	P	P	P	F	E	PF	F	F	G	P
velvetleaf	P	P	P	P	PF	GE	GE	---	F	GE	G

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = less than 70% control; - = Insufficient Data.

²PPI, Preplant Incorporated.

³PRE, Preemergence.

Preplant Incorporated Herbicides for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
<i>diclosulam</i> Strongarm 84WDG	0.45 oz	0.024 lb	2	30 days	12 hours	---
<p>Comments: <i>Diclosulam</i> provides general broadleaf weed control. Incorporate into top 1-3 inches of final seedbed. Good to excellent control of many species including benghal dayflower, bristly starbur, annual morningglory, and eclipta. Should be tank-mixed with <i>dimethenamid-p</i>, <i>s-metolachlor/metolachlor</i>, <i>ethafluralin</i>, or <i>pendimethalin</i> for grass control. Poor control of sicklepod. Control of nutsedge can be improved with a tank mix of <i>metolachlor</i>.</p>						
<i>dimethenamid-p</i> Outlook 6EC	8-12 fl oz	0.38-0.56 lb	15	80 days	12 hours	---
<p>Comments: Controls small seeded annual grass and broadleaf weeds. Provides suppression of yellow nutsedge but not purple nutsedge. May be tank-mixed with <i>pendimethalin</i> or <i>ethafluralin</i> for control of Texas panicum. Soil incorporated <i>dimethenamid-p</i> generally provides better control of yellow nutsedge than surface applied.</p>						
<i>ethafluralin</i> Sonalan HFP	2.0 pt	0.75 lb	3	---	24 hours	---
<p>Comments: Controls annual grasses and small-seeded broadleaf weeds. Incorporate 2-3 inches deep within 2 days of application. Incorporation with implements other than power tiller requires two passes, preferably at cross angles. May be tank-mixed with <i>dimethenamid-p</i> or <i>metolachlor</i> for control of yellow nutsedge. <i>Ethafluralin</i> may also be applied as a surface application to freshly prepared seedbeds but must be incorporated with a 0.5 inch of rainfall or irrigation event within 2 days after application.</p>						
<i>imazethapyr</i> Pursuit 2AS	4.0 oz	0.063 lb	2	85 days	4 hours	---
<p>Comments: Controls purple and yellow nutsedge, wild poinsettia, wild radish, pigweed, and several other annual species. Does not control sicklepod. <i>Shallow</i> incorporation is preferred. May be tank-mixed with <i>metolachlor</i>, <i>pendimethalin</i>, or <i>ethafluralin</i> for improved grass control including Texas panicum. Incorporated treatments are more persistent than preemergence or postemergence applications and could result in carryover to the rotational crop.</p>						
<i>metolachlor</i> (various)	1.0-1.33 pt	1.0-1.33 lb	15	90 days	24 hours	---
<i>s-metolachlor</i> (various)	1.0-1.33 pt	0.95-1.27 lb				
<p>Comments: Controls small seeded annual grass and broadleaf weeds and may provide limited Florida beggarweed suppression. <i>Metolachlor</i> controls or suppresses yellow nutsedge but not purple nutsedge. Incorporation with implements other than power tiller requires two passes, preferably at cross angles. Deep incorporation may reduce effectiveness. May be tank-mixed with <i>pendimethalin</i> or <i>ethafluralin</i> for Texas panicum control. PPI treatments provide better control of nutsedge. Heavy rainfall after planting and/or non-uniform incorporation may result in crop injury including delayed emergence and stunted growth of emerging plants. The generic formulations of <i>metolachlor</i> may not provide the same length of residual control as <i>s-metolachlor</i>.</p>						
<i>pendimethalin</i> Prowl H ₂ O 3.8CS Prowl 3.3EC	2.0 pt 2.4 pt	0.95 lb 0.99 lb	3	21 days	24 hours	---
<p>Comments: Controls annual grasses and small-seeded broadleaf weeds. Incorporate 1-2 inches deep within 7 days of application. May be tank-mixed with <i>dimethenamid-p</i>, <i>metolachlor</i>, <i>acetochlor</i>, or <i>imazethapyr</i> for control of mixed infestations of annual grasses and nutsedge. <i>Pendimethalin</i> can be applied immediately after planting to a freshly prepared seedbed up to 2 days after planting but before crop emergence. However, irrigation or rainfall is needed within 48 hours for optimum activation.</p>						

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Chemigation for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
<i>metolachlor</i> (various)			15	90 days	24 hours	---
<i>s-metolachlor</i> (various)			15			
or <i>pendimethalin</i> Prowl H2O 3.8SC Prowl 3.3EC			3			

Comments: Use at normal recommended rates. May be applied by injection through center pivot irrigation systems. Apply after planting but before crop emergence. Requires proper system calibration and safety devices (check valves, cutoff switches, etc.) to provide effective weed control and prevent environmental contamination. Accurate herbicide application through chemigation may provide superior weed control compared to conventional ground applications. The generic formulations of *metolachlor* may not provide the same length of residual control as *s-metolachlor*.

Preemergence Herbicides for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
<i>acetochlor</i> Warrant 3ME	1.25-2.0 qt	1.125-1.5 lb	15	90 days	12 hours	---

Comments: *Acetochlor* provides residual control of small-seeded broadleaves (including ALS-resistant Palmer amaranth) and grasses. Apply after planting but before weeds germinate. The optimum rate of *acetochlor* is 3 pt/A. Do not exceed 4.0 qt/A of *acetochlor* per season. Environmental conditions that follow application of *acetochlor* including cold, wet soils or saturated conditions from excessive rain may result in crop injury. *Acetochlor* may be tank mixed with *pendimethalin*, *ethafluralin*, *diclosulam*, or *flumioxazin*.

<i>diclosulam</i> Strongarm 84WDG	0.45 oz	0.024 lb	2	30 days	12 hours	---
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Comments: Apply *diclosulam* after planting up to cracking. *Diclosulam* provides good to excellent control of several broadleaf weed species including pigweeds, bristly starbur, eclipta, and annual morningglories. *Diclosulam* is not effective until rainfall or irrigation event of at least 0.25 to 0.5 inches has occurred. Should be tank-mixed with a grass herbicide, such as *metolachlor*, *pendimethalin*, *ethafluralin*, or *dimethanemid*. Poor control of sicklepod. Nutsedge control can vary depending on weed density or environmental conditions (especially soil moisture).

<i>dimethenamid-p</i> Outlook 6EC	8-12 fl oz	0.38-0.56 lb	15	80 days	12 hours	---
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Comments: *Dimethenamid-p* controls some small seeded annual grasses broadleaf weeds. Provides some suppression of sicklepod. May be tank- mixed with *metolachlor*, *pendimethalin*, or *ethafluralin* for improved grass control including Texas panicum. Apply after planting and before crop and weeds emerge. May be used in a split application method. Preemergence treatments generally provide better broadleaf weed control/suppression. Do not exceed 21 oz/A/year of *dimethenamid-p*.

<i>ethafluralin</i> Sonalan HFP	2.0 pt	0.75 lb	3	---	24 hours	---
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Comments: *Ethafluralin* may be applied as a surface application to freshly prepared seedbeds but must be incorporated by 0.5-1.0" of rainfall or irrigation within 2 days after application. Controls annual grasses and small-seeded broadleaf weeds. May be tank-mixed with *dimethenamid-p* or *metolachlor* for control of yellow nutsedge.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Preemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				

<i>fluridone</i>		0.113 lb	12	---	48 hours	---
Brake 1.2SL	12 fl oz					

Comments: Very effective on Palmer amaranth (including *ALS-resistant biotypes*), crabgrass, crowfootgrass and other small seeded annual grass and broadleaf weeds. A residual herbicide tank mix partner, such as *s-metolachlor*, *pendimethalin*, *ethafluralin*, *flumioxazin*, *diclosulam*, or *dimethenamid*, or *acetochlor*, is required with *fluridone*. Apply behind the planter or within 36 hours after planting. Peanut seed should be planted at a minimum of 1.5 inches deep in the furrow. Do not apply more than 16 fl oz per acre per application. Extended drought following application of *fluridone* may reduce effectiveness. A minimum of 0.5 inches of rainfall or irrigation is recommended following application. Peanut cultivar GA-16HO may exhibit more visual injury compared to other cultivars; however, this injury is temporary and does not result in a yield loss. Do not apply *fluridone* in the same field more than 2 consecutive years.

<i>flumioxazin</i>		0.096 lb	14	60 days	12 hours	---
Valor SX 51WDG	3.0 oz					
Valor EZ 4SC	3.0 fl oz					

Comments: Apply *flumioxazin* immediately after planting but no later than 2 days after planting. Significant injury can occur if *flumioxazin* is incorporated or applied 3 or more days after planting. Plant peanuts at least 1.5" deep. DO NOT irrigate when peanuts are cracking. Rainfall or irrigation at cracking will cause temporary crop injury that should not result in reduced yields if applied according to label directions. *Flumioxazin* will provide good to excellent control of many broadleaf weeds including Florida beggarweed, *ALS-Resistant Palmer amaranth*, and tropic croton. *Flumioxazin* will not control annual/perennial grasses, sicklepod, morningglories, nutsedge, and cocklebur. *Flumioxazin* can be tank-mixed with *metolachlor*, *pendimethalin*, *ethafluralin*, or *dimethanemid-p*. Be sure to completely clean spray equipment THE SAME DAY OF USE as directed on the herbicide label. Do not let *flumioxazin* sit in the tank overnight.

<i>imazethapyr</i>		0.063 lb	2	85 days	4 hours	---
Pursuit 2AS	4.0 oz					

Comments: *Imazethapyr* controls purple and yellow nutsedge, Palmer amaranth (*ALS-sensitive*), and several other annual species. Does not provide control of sicklepod. May be tank-mixed with *metolachlor*, *pendimethalin*, or *ethafluralin* for improved annual grass control including Texas panicum. Rainfall is needed for proper activation of *imazethapyr* with a surface application.

<i>metolachlor (various)</i>	1.0-1.33 pt	1.0-1.33 lb	15	90 days	24 hours	---
<i>s-metolachlor (various)</i>	1.0-1.33 pt	0.95-1.27 lb				

Comments: If *metolachlor* was used as a PPI treatment, any additional applications should be delayed until peanuts begin emerging (at cracking). Overlapping applications of PPI followed by at-cracking treatments generally provide improved control of Palmer amaranth, Florida beggarweed, and yellow nutsedge. Controls small seeded annual grasses and broadleaf weeds. Controls or suppresses yellow nutsedge but not purple nutsedge. May be tank-mixed with *pendimethalin* or *ethafluralin* for control of Texas panicum and yellow nutsedge. PPI treatments generally provide better control of yellow nutsedge. The generic formulations of *metolachlor* may not provide the same length of residual control as *s-metolachlor*. Consult label for maximum yearly applications amounts for *metolachlor* and *s-metolachlor*.

<i>pendimethalin</i>			3	21 days	24 hours	---
Prowl H ₂ O 3.8CS	2.0 pt	0.95 lb				
Prowl 3.3EC	2.4 pt	0.99 lb				

Comments: Apply *pendimethalin* immediately after planting to a freshly prepared seedbed up to 2 days after planting but before crop emergence. However, irrigation or rainfall is needed within 48 hours for optimum activation. Provides control of annual grasses and small-seeded broadleaf weeds. May be tank-mixed with *dimethenamid-p*, *metolachlor*, *acetochlor*, or *imazethapyr* for enhanced control of mixed infestations of annual grasses and nutsedge.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Preemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
<i>pyroxasulfone</i>		0.079-0.117 lb	15	7 days	12 hours	---
+		+				
<i>carfentrazone</i>		0.006-0.008 lb	14			
Anthem Flex 4SE	2.7-4.0 fl oz					

Comments: *Pyroxasulfone* plus *carfentrazone* provides residual control of small-seeded broadleaves (including ALS-resistant Palmer amaranth) and grasses. Apply after planting but before weeds germinate. Ensure peanut seed is planted at a minimum of 1.0 inch deep. Shallow planting can lead to increased crop injury risk. The *carfentrazone* component of the herbicide can provide some postemergence activity on emerged broadleaf weeds, but less than 4 inches in height. Do not exceed 4.0 fl oz/A of *pyroxasulfone* plus *carfentrazone* in a single application. Do not apply *pyroxasulfone* plus *carfentrazone* more than 3 times per year or 9.12 fl oz/A/year. The minimum retreatment interval is 14 days. Environmental conditions that follow application including saturated soil conditions from excessive rain may result in crop injury during peanut germination and/or during early seedling development.

<i>sulfentrazone</i>		0.074-0.123 lb	14	None	12 hours	---
+		+				
<i>carfentrazone</i>		0.008-0.014 lb	14			
Spartan Charge 3.5SL	3.0-5.0 fl oz					

Comments: Apply prior to planting or up to 3 days after planting. *Sulfentrazone* plus *carfentrazone* will provide postemergence activity on weeds (less than 3 inches in height) present at the time of application. Sprayer calibration and good agitation are essential with application of *sulfentrazone* plus *carfentrazone*. Avoid excessive overlap of spray swaths. Excellent control of morningglory, Palmer amaranth, lambsquarters, and yellow/purple nutsedge. Do not apply *sulfentrazone* plus *carfentrazone* after crop emergence, at cracking, or if seedling is close to the soil surface as undesirable crop response may occur. Tank mix with *metolachlor*, *pendimethalin*, *ethafluralin*, or *dimethanemid* for improved grass control. Do not apply more than 7.0 fl oz/A of *sulfentrazone* plus *carfentrazone* per 12-month period. Do not apply *sulfentrazone* plus *carfentrazone* to soils classified as sands with less than 1.0% organic matter. Do not irrigate peanuts after a *sulfentrazone* plus *carfentrazone* application with water pH higher than 9. Do not irrigate peanuts during cracking. Do not feed treated peanut forage or peanut hay to livestock.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Weed Response to Postemergence Herbicides for Peanut Weed Management¹

	Paraquat	Paraquat + Storm	Paraquat + Basagran	Basagran	Cadre	Classic	Cobra	Fusilade DX	Poast/Poast Plus	Pursuit	Select/MAX	Storm	Ultra Blazer	2,4-DB
anoda, spurred	P	G	FG	G	G	F	F	P	P	F	P	F	P	P
barnyardgrass	F	FG	FG	P	G	P	G	GE	GE	G	GE	G	G	P
beggarweed, Florida	GE	GE	GE	P	FG	FG	PF	P	P	P	P	P	P	P
bermudagrass	P	P	P	P	P	P	P	G	FG	P	G	P	P	P
citronmelon	F	G	F	P	G	P	G	P	P	P	P	F	F	G
cocklebur, common	G	GE	G	E	E	E	GE	P	P	E	P	GE	G	GE
cowpea	FG	F	F	P	PF	F	PF	P	P	P	P	PF	PF	PF
crabgrass	F	FG	FG	P	GE	P	P	G	GE	PF	GE	P	P	P
crotalaria, showy	F	FG	F	P	F	---	E	P	P	F	P	GE	E	F
croton, tropic	P	G	P	P	P	P	G	P	P	P	P	GE	G	P
crowfootgrass	F	G	G	P	G	P	P	FG	FG	P	G	P	P	P
dayflower, Benghal	G	G	G	G	FG	F	---	P	P	FG	P	F	P	P
eclipta	PF	FG	F	G	PF	P	FG	P	P	P	P	G	FG	P
goosegrass	F	FG	FG	P	F	P	P	G	G	P	G	P	P	P
jimsonweed	P	F	E	E	E	GE	GE	P	P	FG	P	E	E	G
johnsongrass, seedling	F	FG	FG	P	FG	P	P	GE	GE	GE	GE	P	P	P
johnsongrass, rhizome	P	P	P	P	FG	P	P	GE	FG	G	G	P	P	P
lambsquarters, common	F	FG	FG	F	PF	P	P	P	P	P	P	G	G	F
morningglory, annual	P	F	F	F	G	G	G	P	P	G	P	G	GE	G
nutsedge, purple	PF	F	F	P	GE	PF	P	P	P	G	P	P	P	P
nutsedge, yellow	PF	F	FG	G	GE	G	P	P	P	FG	P	F	P	P
panicum, fall	F	FG	FG	P	G	P	P	GE	GE	F	E	P	F	P
panicum, Texas	F	FG	FG	P	FG	P	P	G	GE	PF	GE	P	P	P
pigweed spp.	F	GE	G	P	E	F	E	P	P	E	P	GE	E	F
ALS-resistant	F	GE	G	P	P	P	E	P	P	P	P	GE	E	F
poinsettia, wild	F	G	GE	P	E	P	GE	P	P	PF	P	G	GE	P
purslane, common	G	G	G	G	PF	P	E	P	P	PF	P	GE	G	G
pusley, Florida	P	P	P	P	P	F	G	P	P	P	P	E	E	P
ragweed, common	PF	G	F	F	F	G	E	P	P	P	P	GE	E	F
sandbur, field	F	FG	FG	P	G	P	PF	G	G	---	G	P	P	P
senna, coffee	F	E	E	G	G	P	FG	P	P	F	P	G	E	F
sesbania, hemp	F	G	FG	P	P	E	G	P	P	P	P	E	E	P
sicklepod	FG	G	G	P	GE	G	P	P	P	P	P	P	P	F
sida, prickly	F	G	G	G	G	P	G	P	P	PF	P	G	P	P
signalgrass, broadleaf	F	FG	FG	P	G	P	PF	G	GE	G	GE	P	P	P
smartweed, Pennsylvania	GE	G	G	GE	FG	P	GE	P	P	GE	P	GE	GE	P
starbur, bristly	PF	FG	F	G	F	G	GE	P	P	PF	P	G	G	PF
velvetleaf	F	FG	G	G	G	GE	G	P	P	PF	P	FG	PF	P

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70% control; --- = Insufficient Data.

Early Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				

<i>imazethapyr</i>		0.063 lb	2	85 days	4 hours	4 hours
Pursuit 2AS	4.0 fl oz					

Comments: *Imazethapyr* provides effective control of nutsedge, wild radish, bristly starbur, prickly sida, and several other annual species. Weed size at the time of application is critical for effective control of nutsedge, bristly starbur, and prickly sida. If weeds are emerged, NIS or COC should be included. May also be tank-mixed with *paraquat* or *2,4-DB* for broader spectrum control of emerged weeds. Do not graze or feed treated peanut forage, vines, hay, or straw to livestock.

<i>metolachlor (various)</i>	1.0-1.33 pt	1.0-1.33 lb	15	90 days	24 hours	---
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<i>s-metolachlor (varous)</i>	1.0-1.33 pt	0.95-1.27 lb				
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Comments: Early postemergence applications provide better preemergence control of broadleaf weeds including Palmer amaranth, crabgrass, and Florida pusley. *Metolachlor/s-metolachlor* can be tank-mixed with at-crack *paraquat* programs for improved contact activity and for suppression/control of problem broadleaf weeds and nutsedge. May also be tank-mixed with *bentazon*, *bentazon + 2,4-DB*, or *acifluorfen + bentazon*. DO NOT USE DUAL II MAGNUM OR CINCH FORMULATIONS AFTER PEANUT EMERGENCE. Do apply more than 2.67 pts/A/season of *metolachlor/s-metolachlor*. In general, generic formulations of *metolachlor* do not provide the same length of residual control as similar rates of *s-metolachlor*. Do not graze or feed peanut forage or fodder to livestock for 30 days following application.

<i>paraquat</i>			22	None	12 hours	30 min
2S	8.0-16.0 fl oz	0.125-0.25 lb				
3S	5.4-10.8 fl oz	0.127-0.25 lb				

Comments: *Paraquat* is a RESTRICTED USE PESTICIDE. Provides effective contact control of small, actively growing broadleaf weeds, such as sicklepod, morningglory, and Palmer amaranth. *Paraquat* alone is not effective on smallflower morningglory, prickly sida, or tropic croton. Apply from cracking up to 28 days after ground crack. *Paraquat* may be tank mixed with *metolachlor*, *imazethapyr*, *bentazon*, *2,4-DB*, or *bentazon plus acifluorfen*. Include NIS at 1 qt per 100 gal spray solution with all *paraquat* treatments (Except when adding *s-metolachlor/metolachlor* to the tank mix). Do not make more than 2 applications per season. Do not apply a total of more than 10.8 oz/A per year (*paraquat* 3S) or 16.0 oz/A per year (*paraquat* 2S). Crop response is usually temporary. Conditions of high humidity, wet foliage, and/or wet soils can result in greater foliage burn. *Paraquat* performance can be enhanced by 1) applying in a minimum spray volume of 15 GPA; 2) using flat fan spray nozzles; 3) decreasing ground speed; and 4) using lower spray pressures (30 PSI). Tank mixing a residual herbicide, such as *s-metolachlor/metolachlor*, *acetochlor*, *dimethenamid-p*, or *pyroxasulfone*, will improve long term control of Palmer amaranth (i.e., use of over-lapping residuals).

<i>paraquat</i>			22	None	12 hours	4 hours
2S	8.0-16.0 fl oz	0.125-0.25 lb				
3S	5.4-10.8 fl oz	0.127-0.25 lb				
+	+	+				
<i>bentazon</i>		0.5 lb	6	50 days	48 hours	
Basagran 4S	1.0 pt					
Basagran 5L	0.8 pt					

Comments: *Paraquat* is a RESTRICTED USE PESTICIDE. Provides early season weed control and suppression of yellow nutsedge. Generally, this *paraquat* combination has the lowest potential for peanut injury than other *paraquat* treatment combinations. A lower rate of *bentazon* (0.5 pt/A) can reduce the potential for peanut foliar burn. Apply anytime up to 28 days after ground crack. Include NIS at 1 qt per 100 gal spray solution with all *paraquat* treatments (Except when adding *s-metolachlor/metolachlor* to the tank mix). *Paraquat* performance can be enhanced by 1) applying in a minimum spray volume of 15 GPA; 2) using flat fan spray nozzles; 3) decreasing ground speed; and 4) using lower spray pressures (30 PSI). Tank mixing a residual herbicide, such as *s-metolachlor/metolachlor*, *acetochlor*, *dimethenamid-p*, or *pyroxasulfone*, will improve long term control of Palmer amaranth (i.e., use of over-lapping residuals).

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Early Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
<i>paraquat</i> 2S	8.0-16.0 fl oz	0.125-0.25 lb	22	None	12 hours	30 min
3S						
+	+	+				
<i>bentazon</i> +		0.33-0.5 lb	6			
<i>acifluorfen</i> Storm 4EC	1.0-1.5 pt	0.17-0.25 lb	14	75 days	48 hours	4 hours
-or- <i>imazethapyr</i> Pursuit 2AS						
	4.0 fl oz	0.063 lb	2	85 days	4 hours	4 hours

Comments: *Paraquat* is a RESTRICTED USE PESTICIDE. This combination provides early, broad-spectrum weed control. Provides some suppression of yellow nutsedge. Apply anytime up to 28 days after cracking. Add NIS at 1 qt/100 gal spray solution with all *paraquat* tank mixtures (*Except* when adding *s-metolachlor/metolachlor* to the tank mix). *Paraquat* performance can be enhanced by 1) applying in a minimum spray volume of 15 GPA; 2) using flat fan spray nozzles; 3) decreasing ground speed; and 4) using lower spray pressures (30 PSI). Tank mixing a residual herbicide, such as *s-metolachlor/metolachlor*, *acetochlor*, *dimethenamid-p*, or *pyroxasulfone*, will improve long term control of Palmer amaranth (i.e., use of over-lapping residuals).

Postemergence Herbicides for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
<i>acetochlor</i> Warrant 3ME	1.25-2.0 qt	1.125-1.5 lb	15	90 days	12 hours	---
<i>acifluorfen</i> Ultra Blazer 2S	0.5-1.5 pt	0.125-0.38 lb	14	75 days	48 hours	4 hours

Comments: *Acetochlor* provides residual control of small-seeded broadleaves (i.e., ALS-resistant Palmer amaranth) and grasses. Apply after crop emergence up to flowering (beginning bloom, R1) but before weeds germinate. The optimum application rate of *acetochlor* is 3 pt/A. Do not exceed 4.0 qt/A of *acetochlor* per season. Allow at least 7 days between sequential applications. *Acetochlor* should be tank mixed with *paraquat*, *imazapic*, *lactofen*, *bentazon* + *acifluorfen*, *acifluorfen*, or *2,4-DB* if weeds are emerged at the time of application. Environmental conditions that follow an application of *acetochlor* including cold, wet soils or saturated conditions from excessive rain may result in crop injury.

Comments: *Acifluorfen* provides control of small actively growing cocklebur, sicklepod, morningglories, and tropic croton. Check product label for the appropriate use rate according to weed size and species. Use 1.0 pt/A or less for control of highly sensitive species, such as hemp sesbania and showy crotalaria. Slight to moderate peanut foliage burn may result. Apply with NIS at 1 qt/100 gal spray solution (0.25% v/v). Allow a minimum of 15 days between sequential applications. May be tank-mixed with *2,4-DB* (1 pt/A). *Acifluorfen* + *2,4-DB* can be more injurious to peanuts than either product alone. May be tank-mixed with *bentazon* for improved control of broadleaf weeds, such as morningglories, cocklebur, and prickly sida. Do not apply more than 2 pt/A per season as a postemergence treatment. Do not use treated peanut vines for feed or forage.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				

<i>bentazon</i>		0.75-1.0 lb	6	12 days	48 hours	4 hours
Basagran 4S	1.5-2.0 pt					
Basagran 5L	1.2-1.6 pt					

Comments: Apply *bentazon* from cracking through pegging for postemergence control of yellow nutsedge, tropic croton, cocklebur, bristly starbur, smallflower morningglory, prickly sida, and other small broadleaf weeds. Treat when weeds are small and actively growing. Use the higher rate when weeds are large. For yellow nutsedge, apply 1.5-2.0 pts (4S) or 1.2-1.6 pts (5L) when 8 inches or less and then retreat two weeks later with the same rate. Add COC at 1 gal/100 gals or MSO at 1 gal/100 gals or NIS at 1-2 qt/100 gals plus AMS at 8.5 to 17 lbs/100 gals of spray solution. Do not use an oil-based adjuvant (COC/MSO) if tank mixing *bentazon* with *paraquat*. In-furrow treatments of insecticides and nematicides may predispose peanuts to injury from *bentazon*. *Bentazon* may be tank mixed with *imazapic*, *pyraclostrobin* (HEADLINE fungicide), *dimethenamid-p*, *sethoxydim*, *fluxapyroxad* + *pyraclostrobin* (PRIAXOR fungicide), *imazethapyr*, *2,4-DB* (amine formulation only), *lactofen*, *paraquat*, or *acifluorfen*. Do not add UAN or AMS to the tank mix of *bentazon*, *sethoxydim*, or *acifluorfen*. Do not add any additives to the tank mix of *bentazon* and *2,4-DB* (amine). Do not graze treated peanut fields for at least 50 days after last *bentazon* application.

<i>bentazon</i>		0.5 lb	6	75 days	48 hours	4 hours
+		+				
<i>acifluorfen</i>		0.25 lb	14			
Storm 4S	1.5 pt					

Comments: *Bentazon* + *acifluorfen* controls actively growing (<4 inches) annual morningglories, sicklepod, Palmer amaranth, cocklebur, prickly sida, ragweed, eclipta, tropic croton, and several other broadleaf weeds with less injury than *acifluorfen* alone. Do not make a sequential application of *acifluorfen* or *bentazon* + *acifluorfen* within 15 days following the initial application of *bentazon* + *acifluorfen*. Include NIS or COC. *Bentazon* + *acifluorfen* may be tank mixed with *2,4-DB* or *paraquat*. Do not graze or feed treated peanut forage, vines, hay, or straw to livestock.

<i>carfentrazone</i>	1.0-2.0 fl oz	0.016-0.031 lb	14	7 days	12 hours	6-8 hrs
Aim 2EC						

Comments: Apply *carfentrazone* any time during the growing season up to 7 days before harvest for postemergence control of small broadleaf weeds (i.e., less than 4 inches tall). Use the higher rate for larger weed sizes. Use in combination with either a NIS (0.25% v/v), COC (1% v/v), or MSO (1-2% v/v). Coverage is essential for satisfactory performance. *Carfentrazone* may cause peanut leaf spotting or burning. Use at least 15 GPA for optimum results. Do not apply more than 6.1 fl oz/A/season. Do not feed immature peanut plants or peanut hay to livestock.

<i>chlorimuron</i>		0.008 lb	2	45 days	12 hours	1 hour
Classic 25DF	0.5 oz					

Comments: Apply *chlorimuron* 60 days after planting for mid-season sicklepod control or suppression. Include nonionic surfactant at 1 qt/100 gals spray solution with all *chlorimuron* applications. Addition of ammonium sulfate (2 lb/A) or feed grade urea (2 gal/A) improves activity on bristly starbur. Do not apply *chlorimuron* during periods of drought/heat stress because of potential for poor weed control and crop injury. Temporary yellowing of peanut foliage and a reduction in canopy growth may occur. Can be tank-mixed with *chlorothalonil* (BRAVO fungicide) or *2,4-DB*. However, combinations of *chlorimuron* + *2,4-DB* may result in significantly more foliar crop injury compared to *chlorimuron* alone. Do not use *chlorimuron* on Spanish or Georgia-06G peanut varieties. Do not use *chlorimuron* with *2,4-DB* on Southern Runner. Do not tank-mix *chlorimuron* with elemental sulfur. Do not graze treated field or harvest for forage or hay.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				

<i>clethodim</i>		0.094-0.25 lb	1	40 days	24 hours	1 hour
Select 2EC	6.0-16.0 fl oz					
Select MAX 0.97EC	9.0-16.0 fl oz					

Comments: For control of annual and perennial grasses. Apply *clethodim* when grasses are small (<6 inches) and actively growing. Under favorable conditions, large Texas panicum and bermudagrass can be effectively controlled. Heavy bermudagrass pressure or larger Texas panicum will require a 2nd application. When tank-mixing with a broadleaf herbicide or controlling perennial grasses, increase product use rates (8-16 ozs/A-SELECT; 16-32 oz/A-SELECT MAX). Do not apply more than 32 oz/A/year (SELECT) or 64 oz/A/year (SELECT MAX). Always a COC or MSO at 1% v/v with *clethodim* applications. A NIS (0.25% v/v) may be substituted for COC/MSO to reduce crop injury potential but may result in reduced grass control. Apply SELECT at 16-32 fl oz/A or SELECT MAX at 32-64 fl oz/A for suppression of annual and perennial grasses exceeding recommended heights to enhance harvest efficiency. May be tank-mixed with *bentazon*, *acifluorfen*, *acifluorfen + bentazon*, *acephate* (ORTHENE insecticide), *fenpropathrin* (DANITOL insecticide/miticide), or *tebuconazole* (FOLICUR fungicide). Do not tank-mix with chlorothalonil products or reduced grass control can occur.

<i>diclosulam</i>		0.024 lb	2	30 days	12 hours	---
Strongarm 84WDG	0.45 oz					

Comments: Apply *diclosulam* from cracking to the initiation of flowering (beginning bloom, R1), but no later than 30 days after planting. The optimum growth stage to apply *diclosulam* for Benghal dayflower control is at the 1- to 2-leaf growth stage and actively growing. Add a non-ionic surfactant at 1 qt per 100 gal of spray solution for optimum foliar activity. *Diclosulam* maybe tank mixed with other postemergence herbicides labeled for peanut. *Diclosulam* does not control grasses, tank mix with a preemergence or postemergence grass herbicide. Do not apply more 0.45 oz/A of *diclosulam* from all use patterns (preemergence, preplant incorporated, or postemergence) per season. *Diclosulam* may cause temporary yellowing or chlorosis of peanut foliage after application and symptoms will vary according to environmental and crop growth factors.

<i>dimethenamid-p</i>		0.38-0.56 lb	15	80 days	12 hours	---
Outlook 6EC	8-12 fl oz					

Comments: *Dimethenamid-p* provides residual control of small seeded annual grasses and broadleaf weeds. Provides some suppression of sicklepod, annual morningglory, and Texas panicum. Do not exceed 21 oz/A/year of *dimethenamid-p*. Peanut hay or straw may be grazed or fed to livestock 80 or more days after application of *dimethenamid-p*.

<i>fluzifop-p-butyl</i>		0.125-0.375 lb	1	40 days	12 hours	1 hour
Fusilade DX 2EC	8.0-24.0 fl oz					

Comments: For the control of annual and perennial grass weeds. Do not apply more than 48 oz/A/season. Do not apply more than 24 oz/A/application. Wait a minimum of 14 days between applications. Use a NIS at 1 qt or COC at 1 gal per 100 gal of spray solution. *Fluzifop* does have postemergence activity on bristly starbur. Do not feed treated plants to livestock or harvest for livestock feed.

<i>imazapic</i>		0.063 lb	2	90 days	12 hours	3 hours
Cadre 2AS	4.0 fl oz					
Impose 2AS						

Comments: *Imazapic* provides excellent control of many broadleaf and grass weeds and both purple and yellow nutsedge. Add a NIS (1 qt per 100 gal of spray solution) or COC (1 qt/A) to the spray mixture. Apply as an early postemergence treatment when weeds are less than 2-3 inches in height and actively growing. Under conditions of heavy weed pressure, applications of *imazapic* 10-14 days following an at-cracking treatment (i.e., *paraquat*) can improve long term control. May be tank mixed with 2,4-DB for enhanced morningglory and sicklepod control. Tank mixing *paraquat* with *imazapic* may result in increased peanut injury. Use of *bentazon* in combination with *imazapic* may also result in reduced weed control. Do not tank-mix *imazapic* with postemergence grass herbicides.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				

<i>imazethapyr</i>		0.063 lb	2	85 days	4 hours	1 hour
Pursuit 2AS	4.0 fl oz					

Comments: Apply *imazethapyr* when weeds are small and actively growing. Controls pigweeds, morningglories, bristly starbur, cocklebur, and spurge. Add NIS at 1 qt/100 gal to the spray tank solution. Compared to previous application timings, *imazethapyr* is weak on nutsedge, Florida pusley, Texas panicum, and goosegrass. *Imazethapyr* may be tank-mixed or used in sequence with herbicides approved for use in peanut. Do not graze or feed treated peanut forage, vines, hay, or straw to livestock.

<i>lactofen</i>		0.20 lb	14	45 days	12 hours	30 min
Cobra 2EC	12.5 oz					

Comments: Apply *lactofen* to peanuts after reaching the 6th true leaf growth stage. Add a COC at 1% v/v (1 gal/100 gals) to the tank mix. Provides good control of small, actively growing pigweeds, morningglories, and sicklepod. *Lactofen* can be tank-mixed with *bentazon*, *imazapic*, *imazethapyr*, *chlorimuron*, *s-metolachlor/metolachlor*, *dimethanemid-p*, *sethoxydim*, or *2,4-DB*. Do not exceed 25 fl oz/A of *lactofen* per season. Do not make sequential applications of *lactofen* within 14 days of the first application. Do not make more than two *lactofen* applications per season. Do use treated peanut foliage and vines for feed or forage.

<i>pyroxasulfone</i>		0.080-0.112 lb	15	0 days	12 hours	---
Zidua 0.85WG	1.5-2.1 oz					
Zidua 4.17SC	2.5-3.5 fl oz					

Comments: Apply *pyroxasulfone* to peanuts from at-cracking to the 1st trifoliolate growth stage through beginning pod formation growth stage (R3) for residual control of weeds germinating after application. Tank mix partners include, but are not limited to *bentazon*, *dimethanemid-p*, *sethoxydim*, *pendimethalin*, *imazethapyr* and/or *paraquat*. *Pyroxasulfone* may be tank mixed or applied sequentially with fungicide and/or insecticide products labeled for peanuts. If additional applications of *pyroxasulfone* are needed during the growing season, then the maximum combined rates from all applications must not exceed 5 oz/A (ZIDUA WG) or 8.25 fl oz (ZIDUA SC) per season. The maximum number of applications per season is 3. Sequential application timings must be separated by at least 14 days.

<i>pyroxasulfone</i>		0.079-0.117 lb	15	7 days	12 hours	---
+		+				
<i>carfentrazone</i>		0.006-0.008 lb	14			
Anthem Flex 4SE	2.7-4.0 fl oz					

Comments: The *pyroxasulfone* component of ANTHEM FLEX provides residual control of small-seeded broadleaves (including ALS-resistant Palmer amaranth) and grasses. Ensure peanut seed is planted at a minimum of 1.0 inch deep. Shallow planting can lead to increased crop injury risk. The *carfentrazone* component of the herbicide can provide some postemergence activity of small, actively growing broadleaf weeds. Do not exceed 4.0 fl oz/A of *pyroxasulfone* plus *carfentrazone* in a single application. Do not apply *pyroxasulfone* plus *carfentrazone* more than 3 times per year or 9.12 fl oz/A/year. The minimum retreatment interval is 14 days. Environmental conditions that follow application including saturated soil conditions from excessive rain may result in crop injury during peanut germination and/or during early seedling development.

<i>sethoxydim</i>		0.19-0.28 lb	1	40 days	12 hours	1 hour
Poast 1.5EC	1.0-1.5 pt					
Poast Plus 1.0EC	1.5-2.25 pt					

Comments: For control of annual and perennial grasses. Apply when annual grasses are small (1-6 inches) and actively growing. Large Texas panicum and other grasses can be controlled if optimum growing conditions are present at the time of application (*but, don't wait too long to spray*). For perennial grass control, two applications are often needed for satisfactory control. Add COC at 1 qt/A with all *sethoxydim* tank mixes. Tank-mixing *sethoxydim* with other broadleaf herbicides, such as *2,4-DB*, *acifluorfen + bentazon*, *acifluorfen* or *bentazon* may reduce grass control. Do not apply foliar sulfur 14 days before or after application to minimize risk of peanut foliage burn. Reduced spray volumes (10 GPA) may improve grass control. Do not allow livestock to graze or be fed treated vines.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Postemergence Herbicides for Weed Management in Peanut (cont)

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
2,4-DB			4	45-60 days*	48 hours	1 hour
1.75S	14-28 fl oz	0.19-0.38 lb				
2.0S	13-26 fl oz	0.20-0.40 lb				

Comments: Apply 2,4-DB as an over-the-top treatment for broadleaf weed control. Use rates and application timing varies by specific product label. For control of annual morningglories, sicklepod, prickly sida, cocklebur, and hemp sesbania, apply 2,4-DB when weeds are less than 4 inches in height. A second application may be necessary, but do not make more than 2 applications per season. Do not apply if peanuts are under drought stress. 2,4-DB may be applied from 2 weeks after planting up to 12 weeks after planting. 2,4-DB may be tank mixed with fungicides labeled for peanuts. Do not tank-mix with postemergence grass herbicides. Do not feed treated peanut vines or peanut hay to livestock. *Refer to product label for specific preharvest interval.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Non-Selective Applicator for Weed Management in Peanut

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
paraquat		0.25 lb	22	15 days	12 hours	30 min
2S	0.67 pt					

Comments: Paraquat is a RESTRICTED USE PESTICIDE. Mix 1-part paraquat with 1 to 1.5 parts water to prepare a 40-50% solution. Add NIS at 0.25% v/v to the finished volume of the spray tank. Set equipment for an application rate of 2 pt/A of the herbicide:water mixture. Apply through a non-selective applicator, such as recirculating rope or carpet roller, for suppression and/or control of large ALS-resistant Palmer amaranth and/or to prevent seed production (application must be made before appearance of seed heads). Make application when target weed(s) are taller than the peanut canopy and set equipment to minimize dripping. Low ground speed (5 mph or less) enhances coverage and activity of paraquat. Do not exceed 0.5 lb ai/A (1 qt/A) total for the entire growing season from all paraquat applications. Do not allow livestock to graze in treated areas. Do not feed hay or threshing from treated fields to livestock.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Harvest Aids for Peanut

Herbicide	Rate/Acre Broadcast		MOA	PHI	REI	Rainfast Period
	Formulation	Active Ingredient				
<i>carfentrazone</i> Aim 2EC	1.0-2.0 oz	0.016-0.031 lb	14	7 days	12 hours	6-8 hours

Comments: Apply *carfentrazone* for late-season desiccation/defoliation of troublesome broadleaf weeds present at harvest. *Carfentrazone* is less effective on smallflower morningglory. Use in combination with either a NIS (0.25% v/v) or COC (1% v/v). Coverage is essential for satisfactory performance. *Carfentrazone* may cause peanut leaf spotting or burning. Use at least 15 GPA for optimum results. Do not graze or feed treated peanut hay to livestock. Do not exceed 2.0 fl oz/A/season as a harvest aid. Do not make more than one application per season.

MOA, mode-of-action; REI, reentry interval; PHI, preharvest interval

Benghal Dayflower Management in Peanut

May is the optimum planting window for peanuts in South Carolina which also corresponds to peak Benghal dayflower germination and emergence (May-July). During this period, peanuts are small with large gaps between rows resulting in rapid emergence, establishment, and spread of Benghal dayflower. Non-selective herbicides, such as Liberty and *glyphosate*, which are effective on small Benghal Dayflower are not registered for use in-crop in peanuts. Postemergence choices for Benghal dayflower control in peanut are limited. The key to managing Benghal dayflower in peanut is overlapping soil residual herbicides during the season.

Application Timing	Herbicide Program(s)
Preemergence ^a	Valor (<i>flumioxazin</i>) + Dual Magnum (<i>s-metolachlor</i>)
At-Crack ^b	paraquat + Storm (<i>acifluorfen</i> + <i>bentazon</i>) + Dual Magnum <u>or</u> paraquat + Storm + Warrant (<i>acetochlor</i>) <u>or</u> paraquat + Basagran (<i>bentazon</i>) + Zidua (<i>pyroxasulfone</i>) <u>or</u> paraquat + Strongarm (<i>diclosulam</i>) + Warrant <u>or</u> Zidua
Mid-Postemergence ^c	Cadre (<i>imazapic</i>) + Dual Magnum + 2,4-DB <u>or</u> Cadre + Strongarm + Dual Magnum <u>or</u> Cadre + Warrant + 2,4-DB <u>or</u> Cadre + Zidua + 2,4-DB

^aImmediately after planting and before Benghal dayflower emergence; ^b14 days after planting, Benghal dayflower less than 2 inches in height; ^c28 to 30 days after planting, Benghal dayflower less than 2 inches in height.

Source: Marshall M. Herbicide Options for Benghal Dayflower Control in Field Crops. Clemson (SC): Clemson Cooperative Extension, Land-Grant Press by Clemson Extension; 2020 Nov. LGP 1101. <http://lgpress.clemson.edu/publication/herbicide-options-for-benghal-dayflower-control-in-field-crops/>.

Optimum Height Recommendations for Postemergence Peanut Herbicides

	Barnyardgrass	Bermudagrass (stolon)	Crabgrass	Crowfootgrass	Goosegrass	Fall Panicum	Johsongrass (rhizome)	Sandburs	Broadleaf Signalgrass	Texas Panicum
	Optimum Weed Height (in)									
Cadre	--	--	4	2	2*	4	8-10	4	4	2
Fusilade	2-3	4-8 (1 st)** 4-8 (2 nd)**	1-2	--	2-4	2-6	8-18 (1 st) 6-12 (2 nd)	2-6	2-4	2-8
Poast	8	6 (1 st)** 4 (2 nd)**	6	--	6	8	10 (1 st) 8 (2 nd)	3	8	8
Poast Plus	8	6 (1 st)** 4 (2 nd)**	6	---	6	8	25 (1 st) 12 (2 nd)	3	8	8
Select	2-8	6 (1 st)** 6 (2 nd)**	2-6**	2-6**	2-6**	2-8	12-24 (1 st) 6-18 (2 nd)	2-6	2-6	2-6
SelectMAX	2-8	6 (1 st)** 6 (2 nd)**	2-6**	2-6**	2-6**	2-8	12-24 (1 st) 6-18 (2 nd)	2-6	2-6	2-6

--, not on product label; *, suppression only; **, indicates lateral growth/regrowth of the weed.

PEANUT DISEASE MANAGEMENT

Dan Anco, Extension Peanut Specialist

Seedling Diseases:

All peanut seed should be treated with a fungicide to reduce the incidence of seed-transmitted and soilborne seedling diseases such as *Aspergillus* crown rot, *Cylindrocladium*, *Pythium* and *Rhizoctonia*. **Rancona V PD** (ipconazole + carboxin + metalaxyl) has largely replaced **Dynasty PD** (mefenoxam + fludioxonil + azoxystrobin) as the industry standard. **Vitavax PC** (Captan + PCNB + carboxin), **Trilex Star** (Captan + trifloxystrobin + metalaxyl + thiophanate-methyl), and **Trilex Optimum** (Captan + trifloxystrobin + metalaxyl) seed treatments have been effective in reducing seedling disease and protecting stand counts. Adequate stand counts reduce the risk of tomato spot wilt virus.

Tomato spotted wilt virus (TSWV):

This virus is transmitted to peanuts by thrips, primarily tobacco thrips. TSWV stunts plants, reduces yield and causes shriveled, misshapen pods. All peanut fields in S. C. are vulnerable to yield loss from TSWV regardless of whether the farm has any history of peanut production.

A 6-step program is recommended to reduce Tomato Spotted Wilt:

Using more of these together improves chances of minimizing TSWV risk and yield loss.

1. **Varietal Resistance** – Varieties with partial resistance to TSWV are listed in the variety characteristic chart of the peanut production guide. No variety is immune.
2. **Planting Date Window** – Early planting (Late April – 10 May) has greater risk of virus infection, but with large acreage, we must start planting the first week of May. Late planting (1 June or later) may also increase virus risk. The thrips model from NCSU (<https://climate.ncsu.edu/cottonTIP>) can be used to provide an indication of how much general thrips pressure is predicted for a location and planting window.
3. **Plant Population/Seeding Rate** – The goal is a uniformly emerged stand of 4 plants per row ft. Plant 6 seeds/row ft (or at least 5/row ft for large seeded Virginia types) into good soil moisture. Uniform emergence and vigorous early growth reduce virus risk.
4. **Insecticide Treatment** – Apply in-furrow treatments of Thimet 20G (4.7 lb/A on 38” rows to all fields. See insecticide table for phorate rates by row spacing. Admire Pro (10 fl oz in-furrow) or Velum Total (18 fl oz/A) tank mixed with inoculant may also be used for preventing thrips stunting under low virus risk (e.g., Bailey, TifNV-High O/L). However, imidacloprid usually increases severity of virus infections.

If thrips are stunting peanut seedlings, treat immediately with acephate: Orthene 75S (0.5-1.0 lb/A) or Orthene 97SP (6-12 oz/A).

5. **Strip-tillage** – Surface crop residue reduces the number of thrips landing in peanut fields, in turn reducing virus infection.
6. **Twin-row planting** – faster ground cover means less virus. Twin-row planting requires a specialized planter.

Tomato spotted wilt management is mostly over when the planter leaves the field.

Leaf Spots and Other Foliar Diseases:

Foliar disease control programs for S. C. are targeted primarily at **late leaf spot** (*Nothopassalora personata*) because this disease most consistently causes economic loss. Late leaf spot spores can be carried for miles in the wind and therefore any field is at some risk regardless of peanut history. However, field history greatly affects late leaf spot risk because leaf spot spores persist on peanut residue in the soil. All fields should be rotated out of peanut for a minimum of two years to reduce late leaf spot pressure (longer is better). Adjacent fields which had poor late leaf spot control at the end of the previous season can also be a source of significant infection, especially if upwind. Fortunately, other row crops and weeds are not significant hosts for late leaf spot. Late leaf spot is diagnosed by the black spores on the underside of dark brown to black lesions on leaves (see pictures). Yellow halos may or may not be present surrounding late leaf spot lesions.

Other foliar fungal diseases include **early leaf spot, pepper spot, leaf scorch, web blotch, Phyllosticta leaf spot, and rust**. There are also several physiological leaf spot symptoms which commonly occur, often in response to stress, such as **“irregular leaf spot”**. Physiological leaf spots do not respond to fungicides and can be difficult to distinguish from fungal diseases in the field. The best and simplest management approach is that if our fungicide program is good enough to prevent the most common and aggressive disease (late leaf spot), then we will usually be OK on the other foliar diseases.

Risk factors for late leaf spot:

- Short rotations (less than 2 years out of peanuts)
- Highly susceptible variety (e.g., Virginia types, TUFRunner 511, Georgia 13M, Spain)
- Late planting (May 26 and later)
- Poor control of volunteer peanuts in rotational crops or nearby fields
- Poor end of season control of late leaf spot in an adjacent upwind field the previous year
- Starting fungicide programs any later than 45 DAP; better early than late
- Extending spray intervals beyond 15 days
- Repeated, frequent periods of leaf wetness: excessive rain, frequent irrigation
- Rain off immediately after application – wait 24 h to irrigate
- Consecutive use of fungicides with the same mode of action (except chlorothalonil); products like strobilurins (Abound, Headline) and Topsin must be tank mixed (with chlorothalonil) to reduce risk of resistance development or control failure

Early Season Protection: Application of Propulse, Proline, or Velum in-furrow at planting can help contribute early-season protection of leaf spots. Our studies from 2017 to 2020 on runner and Virginia type peanuts have shown Thimet applied in-furrow at planting provides significant protection against late leaf spot. This work has been published in 2020 in Plant Disease.

Importance of Chlorothalonil (Bravo and generics): Chlorothalonil is the foundation of peanut leaf spot control programs because it is the only product proven to have multiple modes of action to reduce the risk of developing leaf spot resistance. Multiple sequential chlorothalonil applications have been used for over 40 years without resistance development. Alternating or tank mixing chlorothalonil with other products can delay development of resistance towards those alternative compounds. Chlorothalonil in the last spray can also help prevent resistant leaf spot strains from overwintering and causing infection in the following year.

Slowing a Growing Leaf Spot Epidemic: Effective fungicide programs are designed to prevent disease, not “cure” it after the fact. If something goes wrong and you find late leaf spot lesions in the bottom of the canopy (particularly with > 30 days until harvest) treat immediately with Provost Silver 13 fl oz + Microthiol Disperss 5 lb/A, Topsin 4.5FL 10 fl oz + 1.5 pt Bravo, or Priaxor 4 fl oz + Provost Opti 10.7 fl oz/A. Retreat in 10 days.

White Mold:

White mold (*Sclerotium rolfsii*) is the most consistently damaging soil disease under S. C. conditions. This fungus invades peanut lateral branches in contact with the soil, as well as pods and pegs. White mold infections are driven primarily by high soil temperatures and humidity. Dry weather offers no protection from white mold. Drought can prevent infection from being noticed aboveground, but infection underground on pegs and pods can continue where it may not be noticed until harvest. Some of our most severe white mold outbreaks often occur under drought with excessive canopy temperatures.

Symptoms include dark brown lesions on stems and pods, rotted pods and pegs, wilting of individual or multiple stems and plant death. Unless severely infected, tap roots generally remain intact and flexible with white mold, whereas CBR infection decays tap roots much quicker.

Signs: Mycelium of *S. rolfsii* is white and produces a fan-like growth as it spreads. The resting stage of white mold (sclerotia) persists in the soil from year to year making rotation out of host crops (peanut, soybean and other legumes including many weeds) highly important. These sclerotia can be seen as small ($< 5/64'' = 2 \text{ mm}$), round structures that are initially white and later become tan to dark brown. With ample moisture, sclerotia can be found on infected peanut tissues or leaf litter. **Note:** A similar looking fungus, false white mold (*Phanerochaete*), also produces white mycelium and can be found in peanut fields. False white mold does not produce sclerotia and does not damage peanuts; if it is found on peanuts and is scraped away, tissue beneath it will look healthy.

Risk factors for white mold:

- Peanut or soybean history
- Less than 2 years rotated out of peanut, soybean or other legume
- Any variety other than Bailey, Sullivan, Sugg, Wynne or Georgia 12Y should be considered highly susceptible. AU-NPL 17, FloRun 331, Georgia 14N, TifNV-Hi O/L and Georgia 07W also show some tolerance though not as good as the previous group.
- Early planting (first week of May or earlier); delaying planting until mid-May may help suppress white mold due to higher seedling soil temperatures and faster early root growth
- Lack of rain preventing fungicide from being washed into the soil
- Extended, unusually hot temperatures in July and August

Variety resistance (particularly Bailey, Sullivan, and Georgia 12Y, also FloRun 331 and AU-NPL 17) is far more effective than any chemical treatment in suppressing white mold. These varieties typically control white mold with standard fungicide programs.

Early Season Banded Sprays: Banded application of Proline (38" rows: 5.5 fl oz/A in 20 gal/A on 12" band) OR Elatus (38" rows: maximum 8.9 oz/A in $\geq 10 \text{ gal/A}$, 7 - 10" band) to peanut seedlings at 21 - 35 DAP can improve white mold control under extreme disease pressure. See table on Early Season Band Treatment Options for row-spacing banded rates. See following tables for fungicide efficacy and comments.

Night/Pre-Dawn Spraying: Peanut plants fold their leaves at night making it easier for soil fungicide treatments to reach the base of the plant and soil surface. Applying white mold treatments at night has been shown to increase control effectiveness, at least under severe white mold pressure. If Bravo (a non-systemic) is being relied on for leaf spot control, control of this foliar disease may be reduced with night spraying because of reduced leaf coverage. For growers interested in trying night applications, we recommend the 60, or 60 and 75 DAP treatments as priorities.

Cylindrocladium Black Rot (CBR):

CBR is caused by a soil fungus (*Cylindrocladium parasiticum*) that occurs in the same field areas from year to year, often in low spots. CBR is transmitted from field to field by contaminated seed and equipment. **Rotation** (≥ 2 years out of peanuts and elimination of soybean from the rotation) and **resistance** are the best defenses against severe CBR. Rotation alone will not eliminate significant injury.

Symptoms and signs: When first infected, peanut plants can turn light green or yellow. As CBR infections progress, peanut stems or entire plants wilt and eventually die. CBR rots roots, including the tap root, causing them to turn black and fall apart (tap roots infected by white mold remain intact and flexible much longer). Under drier conditions, symptoms of CBR infection may be limited to chlorotic yellowing and plant stunting. When conditions have been moist, brick-red reproductive structures (perithecia) might appear on crowns, lower stems, pegs and pods. Infected seed can develop cinnamon-colored speckles (microsclerotia) on seed coats before rotting.

Risk factors for CBR:

- Confirmed history of economic CBR loss in the field
- Soybean or peanut history
- Short rotations out of peanut, soybean or other legumes
- Poorly drained, more organic soils such as found in low areas of a field
- Any variety other than Bailey, Perry or Sugg (Emery is particularly susceptible to CBR)
- Lack of control over seed source (seed transmission)
- Early planting (April): lower soil temperatures slow root growth

CBR Management:

Variety resistance (Bailey) is far more effective than any chemical treatment in suppressing CBR. Bailey often adequately suppresses CBR without fumigation or in-furrow fungicides.

On susceptible varieties in fields with a proven history of CBR loss, use **Propulse** (13.6 fl oz/A) OR **Proline** (5.7 fl oz/A) **in-furrow** (with inoculant), OR **fumigate with Vapam (10 gal/A)**. Vapam must be shanked into a bed at ~10" depth 14 days prior to planting. Soil temperature at 4" depth should be at least 60° F. Avoid fumigating when there is a high risk of heavy rain (> 1.0") within 2 days. See the following tables on fungicide efficacy and comments.

Rhizoctonia Limb Rot:

Rhizoctonia Limb Rot is caused by naturally-occurring soil fungi, *Rhizoctonia* spp. (e.g., *R. solani*), that can cause lesions and rot on limbs/stems, leaves, pegs, and pods. Lesions on stems are light to dark brown and often have a target pattern. Dense canopies and prolonged moisture (e.g., irrigation) encourages disease development. Damage caused by tractor traffic increases occurrence of limb rot. Management recommendations are similar as for white mold (see Disease Response Chart for fungicide activity). Rhizoctonia may also cause foliar blight and pod rot. Pod rot from Rhizoc is more dull and dry in appearance compared to Pythium (which looks wet and greasy).

Web Blotch:

Web blotch, caused by *Phoma arachidicola*, produces lesions on upper leaf surfaces. Symptoms start as small, tan to dark brown blotches with irregular edges or netlike gray-brown lesions that can become large (0.5") and cover entire leaves. Older lesions darken and have rough, dull surfaces. Severe infections cause leaves to become brittle, which can lead to substantial defoliation. Web blotch development favors cool, moist conditions and is more common under irrigation. Many of the fungicides effective against late leaf spot share activity towards web blotch (see Disease Response Chart for fungicide activity).

General Guidelines for Fungicide Programs:

- Begin leaf spot control **absolutely no later than 45 DAP**. For high risk situations such as highly susceptible varieties (e.g., Bailey, Sullivan, Georgia 13M, TUFRunner 511), or short rotations, particularly under irrigation, increase late leaf spot protection using one of the options listed in footnotes of the following tables. **Many fields benefit from starting fungicide protection at 30 – 40 DAP when conditions favor leaf spot development.**
- **Apply a soil fungicide (see following disease control table) starting absolutely no later than 60 DAP.** White mold must be prevented. Hot weather accelerates white mold growth.
- If premium fungicides (e.g., Provost Silver, Provysol, Proline, Lucento) are substituted for basic tebuconazole + chlorothalonil treatment, prioritize their use starting at 60 DAP rather than later to get the most potential for improved white mold and/or leaf spot control.
- Soil fungicides must be washed into the soil to be effective against white mold, but **wait 24 – 48 h before irrigating** to also help control leaf spot.
- **Except for treatments containing chlorothalonil (Bravo), do not make consecutive applications of the same mode of action (MOA).** Bravo has multiple modes of action which has allowed for many years of use without leaf spot resistance. In each field, do not apply more than a combined total of 2 strobilurin-containing products (Abound, Elatus, Evito, Headline or Priaxor) in any growing season to reduce risk of resistance, and do not apply strobilurin fungicides or Topsin alone.
- **Never apply Topsin, tebuconazole, or strobilurins (Abound, Headline) alone, and do not make more than 2 tank-mixed Topsin applications per season.** Topsin is very susceptible to development of resistance. Late leaf spot is already resistant to tebuconazole, and it is already resistant to strobilurins in several areas.
- **No fungicide program is fool-proof.** Spot check fields for leaf spot and white mold, particularly from 60 DAP to two weeks before anticipated digging date.
- Under low pressure, a final leaf spot application at 105 DAP may be adequate to provide control through at least a 135 DAP harvest date, but check fields at 105 – 120 DAP. If leaf spot is present on 5% of lower leaves and harvest will be delayed > 135 DAP, apply an additional chlorothalonil treatment. If no leaf spot is present and harvest will be delayed beyond 145 DAP, apply an insurance treatment. Many fields including Virginias require fungicide protection at 120 DAP to manage late leaf spot depending on weather and year. If a leaf spot spray is not warranted, soil disease may still need another application particularly for late maturing cultivars.
- From our studies and work with peanut Extension and research specialists in the VC and southeast, for mature runner types, yield loss starts to become significant after approximately 30% of the canopy becomes defoliated from leaf spot. For mature Virginia types, losses started to become significant at 25% or more canopy defoliation. **For a crop that is not yet at optimal maturity, Virginia types should be dug before defoliation exceeds 40% to prevent economic loss. For not yet mature runners, they appear to tolerate at least 50% defoliation before increasing yield loss. Soil, weather and digging conditions are very important and harvest decisions should take all factors into account.**

Note: The disease control programs on the following pages are example guidelines. Timing should be modified to account for opportunities to wash soil fungicides into the pegging zone if no irrigation is available. Under drought conditions, growers have to rely on judgment of the 5-day weather forecast to decide when to apply a soil fungicide before a rain. Ideally, fungicide treatments would be washed into the soil after 1 – 2 days to get both maximum foliar and soil disease suppression.

DISEASE CONTROL PROGRAM OPTIONS

If premium fungicides are substituted for basic tebuconazole + chlorothalonil (generic Folicur + Bravo), prioritize their use starting 60 DAP rather than later to maximize potential benefits.

Treatment options and timing (days after planting)							
30	45*	60*	75	90	105	120	
Bravo (1-1.5 pt) (+ Cadre) (unless leaf spot risk is known low)	tebuconazole 7.2 + Bravo 1.5 pt	tebuconazole 7.2 + Bravo 1.5 pt	tebuconazole 7.2 + Bravo 1.5 pt	tebuconazole 7.2 + Bravo 1.5 pt	tebuconazole 7.2 + Bravo 1.5 pt	Bravo for late maturing peanuts**	
	tebuconazole 7.2 fl oz + Bravo 1.5 pt	tebuconazole 7.2 + Bravo 1.5 pt	tebuconazole 7.2 + Bravo 1.5 pt	tebuconazole 7.2 + Bravo 1.5 pt	tebuconazole 7.2 + Bravo 1.5 pt		
		Substitute, see below	tebuconazole 7.2 + Bravo 1.5 pt	Substitute, see below	tebuconazole 7.2 fl oz + Bravo 1.5 pt		tebuconazole 7.2 fl oz + Bravo 1.5 pt
			tebuconazole 7.2 + Bravo 1.5 pt		Substitute, see below		
			Substitute, see below	Substitute, see below			
Substitute, see below	Substitute, see below						

*Under high leaf spot risk (e.g., very susceptible variety, irrigated or with frequent rain-off and leaf wetting, or late planting) use a premium fungicide with strong leaf spot activity at 60 DAP; use of additional premium products can improve management. Spray intervals can be reduced to 10 days for improved leaf spot control under frequent rain-off conditions. **Make sure leaf spot prevention begins no later than 45 DAP and soil fungicide is applied no later than 60 DAP.** White mold must be prevented; hot weather and a closed canopy in Jul – Aug accelerates white mold growth. Do not use surfactants or crop oil with fungicides unless necessary for herbicide performance in tank mixes. The goal is to wash white mold fungicides into the soil. Spray **before** irrigation or rain when possible.

**An extra late season Bravo application may be needed for late maturing peanuts or for earlier maturing peanuts if disease is present. If it has been 15 days since the last application and peanuts will be dug within the next 25 days, do not treat unless > 5% of leaflets in the bottom of the canopy have late leaf spot lesions. Never spray fungicide within 2 weeks of harvest – it is off-label and is too late to affect defoliation.

The treatments in the following tables can be substituted for tebuconazole + Bravo from 60 DAP to 105 DAP. Except for treatments containing Bravo (chlorothalonil), consecutive use of the same mode of action (MOA) group is not recommended in order to delay leaf spot resistance. Bravo has multiple modes of action and there has been no evidence of resistance in 40+ years of use.

MOA = Fungicide Resistance Action Committee (FRAC) Mode of Action Group. Having the same mode(s) of action does not mean treatments are equally effective.

There is no single perfect all-around fungicide. The best programs combine several products that complement each other to minimize disease and resistance risk at reasonable cost.

2023 Fungicide Supply

As of January, 2023, there does not appear to be an anticipated shortage of chlorothalonil for the 2023 growing season. Uncertainties remain regarding trade policies with the EU. The following are a few example programs assuming limited chlorothalonil and tebuconazole availability. As always, an effective disease management program strongly benefits from the combined use of multiple integrated pest management practices (e.g., variety resistance, length of rotation period, planting date).

Where available supplies are further limited, the more effective 1.5 pt rate of Bravo listed here may be reduced to the 1 pt rate, or substitutions (Elast, fixed copper...) may be used.

Example treatment options and timing (days after planting) for limited chlorothalonil (Bravo) and

0	30	45	60	75	90	105	120
Higher risk							
Thimet 4.7 lb/A in-furrow at plant	Bravo 1.5 pt	Alto 5.5 oz + Microthiol Disperss 5 lb	Provost Silver 13 oz + Microthiol Disperss 5 lb	Bravo 1.5 pt + teb 7.2 oz	(Provost Silver 13 oz <u>OR</u> Lucento 5.5 oz) + Microthiol Disperss 5 lb	Bravo 1.5 pt + teb 7.2 oz	Bravo 1.5 pt + teb 7.2 oz
Lower risk							
		Bravo 1.5 pt <u>OR</u> Absolute 7 oz	Provost Silver 13 oz <u>OR</u> Elatus 8 oz <u>OR</u> Lucento 5.5 oz	Bravo 1.5 pt + teb 7.2 oz <u>OR</u> Bravo 1.5 pt + Convoy 16 oz	Provost Silver 13 oz <u>OR</u> Elatus 8 oz <u>OR</u> Lucento 5.5 oz	Bravo 1.5 pt + Topsin 10 oz + teb 7.2 oz	Bravo 1.5 pt

tebuconazole (generic Folicur) availability situations

Approximate Rainfast Times After Application for Selected Fungicides

Alto	1 hour
Aproach Prima	1 hour
Bravo WeatherStik	When dry
Elatus	1 hour
Fontelis	1 hour
Headline	When dry
Lucento	2 hours
Miravis	1 hour
Priaxor	When dry
Proline	When dry
Provost Silver	2 hours if dry when applied, 3 hours if wet (dew)
Revytek	When dry
Topsin	2 hours

Rainfast times are more applicable for foliar diseases like late leaf spot than they are for soil diseases, since rain helps fungicides reach lower areas where soil diseases are active.

PEANUT DISEASE CONTROL

FOLIAR DISEASE CONTROL ONLY (Early and late leaf spot, pepper spot, web blotch, rust)			
Product	Rate/A	MOA*	Comments
Bravo Weather Stik 6SC (and chlorothalonil generics)	1.5 pt	M5	Preventative only against leafspot and require excellent coverage. Rust is rare in SC peanut production, but if detected with more than 3 weeks to harvest, include chlorothalonil every 10 days until 2 weeks before harvest.
Bravo + Topsin 4.5 FL or Topsin M WSB	1 pt +10 fl oz 0.5 lb	M5 + 1	Topsin should only be used in Bravo tank mixes. Maximum 2 appl. per season.
Alto 100 SL + Bravo	5.5 fl oz + 24 fl oz	3 + M5	Systemic triazole activity + protectant Bravo.
Miravis 1.67 SC	3.4 fl oz	7	Leaf spot activity, strong residual. Requires leaf spot tank mix partner (Provost Silver) for resistance management and soil fungicide mix. More than 1 application per season not recommended.
Elatus 0.45 WG	7.3-9.5 fl oz	7 + 11	Systemic. Leaf spot activity benefits from Bravo tank mix under high pressure.
Provost Silver 3.5	11-13 fl oz	3	Highly effective against soil and foliar diseases.
Provost Opti 3.6 + Microthiol Disperss	10.7 fl oz + 5 lb	3 + M2	Excellent activity against soil and foliar diseases. Microthiol Disperss greatly enhances leaf spot activity of Provost Opti.
Priaxor 4.17	4-6 fl oz	7 + 11	Systemic activity against leaf spot.
Revytek 3.33	8-15 fl oz	3 + 7 + 11	Highly effective systemic activity against leaf spot. SC white mold data limited.
Bravo + Topguard	1.5 pt + 7- 14 fl oz	M5 + 3	Topguard adds systemic leaf spot control to Bravo.
Absolute 500 SC	3.5 fl oz	3 + 11	Systemic triazole and strobilurin activity.
Headline 2.08 + Bravo	6-9 fl oz + 16 fl oz	11 + M5	Highly systemic and rain-fast. We are seeing reduced strobilurin effectiveness against leaf spot.
Muscle ADV 3.84	2 pt	3 + M5	Add 0.5 pt/A Bravo for late leaf spot use.
Lucento 4.17	5.5 fl oz	3 + 7	Systemic activity against leaf spot.
FOLIAR AND SOIL DISEASE CONTROL (Other than CBR)			
Product	Rate/A	MOA*	Comments
Tebuconazole (generic Folicur 3.6) + Bravo	7.2 fl oz + 1.5 pt	3 + M5	Tebuconazole alone no longer controls leaf spot or web blotch. Must be tank mixed with Bravo.
Convoy 40SC + Bravo	16 fl oz +1.5 pt	7 + M5	Must be tank mixed with Bravo for adequate leaf spot control. Effective white mold suppression.
Umbra 3.37 + Bravo	19-38 fl oz + 1 pt	3 + 7 + M5	Effective white mold suppression. Tank mixing with Bravo improves leaf spot control.
Provost Silver 3.5	13 fl oz	3	Highly effective against soil and foliar diseases.
Elatus 0.45 WG	7.3-9.5 fl oz	7 + 11	Excellent white mold activity. Traditionally excellent leaf spot activity may be becoming variable.
Priaxor 4.17	8 fl oz	7 + 11	Systemic activity against white mold and leaf spot.
Revytek 3.33	15 fl oz	3 + 7 + 11	Highly effective systemic activity against leaf spot. SC white mold data limited.
Fontelis 1.67	16 fl oz	7	Systemic activity against white mold and leaf spot.
Lucento 4.17	5.5 fl oz	3 + 7	Systemic activity against white mold and leaf spot.
Propulse 3.34	13.6 fl oz	3 + 7	Systemic activity against soil and foliar disease.
Provsol	5 to 7 fl oz	3	Systemic activity against soil and foliar disease.
Custodia 2.67 SC	15.5 fl oz	3 + 11	Add 1 pt/A Bravo for late leaf spot use. Max 2 appl.
Muscle ADV 3.84	2 pt	3 + M5	Add 0.5 pt/A Bravo for late leaf spot use.
Headline 2.08 + Bravo	12-15 fl oz + 16 fl oz	11 + M5	Highly systemic and rain-fast. We are seeing reduced strobilurin effectiveness against leaf spot. Headline erratic on white mold due to rapid uptake on leaves.

*Except for treatments containing Bravo (chlorothalonil), consecutive use of the same mode of action (MOA) group is not recommended in order to delay leaf spot resistance.

PEANUT DISEASE CONTROL (cont.)

Early Season Banded Treatment Options for Improved White Mold and Leaf Spot Management			
Product	Rate/A	MOA	Comments
Elatus 0.45 WG	8.9 oz (38" rows)	7 + 11	<p>Recommended as early season (approximately 21 DAP) banded application for high risk white mold fields. May also provide early season leaf spot control. Apply in a minimum of 10 gal/A. Set band width at 7 – 10" for single rows (twin-rows: widen band to cover both rows).</p> <p>Banded rates are 0.5 – 0.65 oz/1,000 row ft, which is equivalent to 8.7 – 9.5 oz/A on 30" rows, 7.3 – 9.4 oz/A on 36" rows, and 6.9 – 8.9 oz/A on 38" rows. Do not exceed 9.5 oz/A.</p>
Proline 480 SC	5.5 fl oz (38" rows) 5.7 fl oz (30", 36" rows)	3	<p>Recommended as early season (21-35 DAP), high volume (20 gal/A) banded application (up to 12" band) for high risk white mold fields. Also provides extended (21 day) early season leaf spot control.</p> <p>Banded rate is 0.4 fl oz/1,000 row ft (maximum 5.7 fl oz/A), which is equivalent to 5.7 fl oz/A on 30" or 36" rows and 5.5 fl oz/A on 38" rows.</p> <p>Proline must be used in-furrow for CBR suppression (see below) and over the top for white mold control.</p>

CBR CONTROL			
Product	Rate/A	MOA	Comments
Proline 480 SC (in-furrow, suppression)	5.5 fl oz (38" rows) 5.7 fl oz (30", 36" rows)	3	<p>Resistance: Bailey variety is more effective than any chemical treatment in reducing CBR loss and often provides adequate control without fumigation or in-furrow fungicide treatment.</p> <p>Crop rotation is extremely important in reducing CBR risk. Delaying planting until mid-May can suppress CBR by increasing soil temp.</p> <p>Proline is applied in-furrow with inoculant. In-furrow rate is 0.4 fl oz/1,000 row ft (maximum 5.7 fl oz/A), equivalent to 5.7 fl oz/A on 30" or 36" rows and 5.5 fl oz/A on 38" rows.</p>
Propulse 3.34 SC (in-furrow, suppression)	13.6 fl oz	3 + 7	<p>Resistance: Bailey variety is more effective than any chemical treatment in reducing CBR loss and often provides adequate control without fumigation or in-furrow fungicide treatment.</p> <p>Crop rotation is extremely important in reducing CBR risk. Delaying planting until mid-May can suppress CBR by increasing soil temp.</p> <p>Propulse is applied in-furrow with inoculant. Also provides effective early season late leaf spot protection</p>
Vapam HL (metam sodium 42%)	10 gal	NC	<p>Resistance: Bailey variety is more effective than any chemical treatment in reducing CBR loss and often provides adequate control without fumigation or in-furrow fungicide treatment.</p> <p>Vapam must be shanked into the soil (8" depth) and bedded at least 14 days prior to planting. Soil temperature at 4" depth should be 60°F. Do not fumigate when rain (1.0" or more) is expected within 48 hrs.</p>

GUIDE TO PEANUT FUNGICIDES

Product	Chemistry	MOA*	Risk of leaf spot resist.	Feed hay	PHI days	Strengths	Limitations
Abound	Strobilurin (azoxystrobin)	11	High	Y	14	Has white mold activity and may be the best Rhizoctonia material. Systemic leaf spot and web blotch activity.	Erratic against established white mold infections 75 – 90 DAP. Mix with Alto or Bravo to improve leaf spot activity.
Absolute	Triazole (tebuconazole) + Strobilurin (trifloxystrobin)	3 + 11	Already resistant + high	N	14	Systematic leaf spot activity.	Less effective against white mold.
Alto	Triazole (cyproconazole)	3	High	Y	30	Systematic leaf spot activity.	Minimal if any soil disease control. Mix with Bravo.
Approach Prima	Triazole (cyproconazole) + Strobilurin (picoxystrobin)	3 + 11	High + high	Y	30	Systemic leaf spot activity.	Minimal if any soil disease control, leaf spot activity benefits from chlorothalonil or sulfur tank mix.
Bravo/ generics	Chloronitrile (chlorothalonil)	M5	Low	N	14	Low cost, reliable leaf spot control. Multiple modes of action reduce risk of leaf spot resistance. Can make multiple consecutive appl.	No soil disease activity. Not curative or systemic. Less effective than many systemics on web blotch. Preventative activity only against leaf spot.
Convoy	Benzamide (flutolanil)	7	Low	N	40	Excellent white mold and Rhizoctonia activity.	No activity against foliar diseases or CBR. Must tank-mix with chlorothalonil.
Custodia	Triazole (tebuconazole) + Strobilurin (azoxystrobin)	3 + 11	Already resistant + high	N	14	Activity against foliar and soil diseases.	Needs Bravo tank-mix for adequate leaf spot control. Max 2 appl. recommended.
Domark	Triazole (tetraconazole)	3	Medium risk	N	14	Systemic activity against leaf spots.	Not effective for soil disease. Requires Bravo tank mix for effective late leaf spot activity.
Elast	Guanidine (dodine)	U12	Low to medium	Y	14	Leaf spot alternative to Bravo for lower disease pressure situations.	Less effective than Bravo for leaf spot on highly susceptible varieties. No soil efficacy.
Elatus	Carboxamide (benzovindiflupyr) + Strobilurin (azoxystrobin)	7 + 11	Medium to high	Y	30	Systemic late leaf spot activity. Excellent activity against white mold.	Alternate with MOA different from FRAC 7 and 11. Requires Bravo tank mix under high late leaf spot pressure.
Endura	Carboxamide (boscalid)	7	Medium to high	N	14	Activity against Sclerotinia blight (not common in SC). Good leaf spot activity.	Inadequate against white mold.
Evito	Strobilurin (fluoxastrobin)	11	High	Y	14	Performance of 5.7 oz similar to 18 oz Abound.	Performance of 5.7 oz similar to 18 oz Abound.

GUIDE TO PEANUT FUNGICIDES (Cont.)

Product	Chemistry	MOA*	Risk of leaf spot resistance	Feed hay	PHI	Strengths	Limitations
Excalia	Carboxamide (inpyrfluxam)	7	Medium to high	N	40	Excellent white mold activity, labeled for Rhizoc.	Minor leaf spot activity, benefits from tank mix.
Folicur/generics	Triazole (tebuconazole)	3	Already resistant	N	14	Very cost-effective control of white mold and limb rot.	Tank-mix with Bravo for leaf spot control.
Fontelis	Carboxamide (penthiopyrad)	7	Medium to high	Y	14	Excellent white mold activity and effective against leaf spot.	Rotate with alternative chemistry to reduce leaf spot resistance risk.
Headline	Strobilurin (pyraclostrobin)	11	High	N	14	Systemic leaf spot activity at 6-9 oz, some white mold activity at 12-15 oz rates. Rapid uptake for systemic activity in leaves.	White mold activity erratic. Leaf spot activity of Headline (and other strobilurins) may have declined. Do not exceed 2 strobilurin appl. per season.
Lucento	Triazole (flutriafol) + Carboxamide (bixafen)	3 + 7	Medium to high	N	14	Systemic leaf spot activity. Active against soil diseases including white mold.	Should be rotated with other products and MOA for effective disease management programs.
Miravis	Carboxamide (pydiflumetofen)	7	Medium to high	Y	14	Leaf spot activity, strong residual	Requires tank mix for soil disease control. Rotate with alternative chemistry to reduce leaf spot resistance risk. >1 app./season not recommended.
Muscle ADV	Triazole (tebuconazole) + Chloronitrile (chlorothalonil)	3 + M5	Already resistant + low	N	14	Activity against foliar and soil diseases.	Needs Bravo tank-mix for adequate leaf spot control.
Priaxor	Carboxamide (fluxapyroxad) + Strobilurin (pyraclostrobin)	7 + 11	Medium to high	N	14	White mold and leaf spot activity at 8 oz. Has demonstrated highly effective leaf spot control.	Maximum of two appl. per season recommended.
Proline	Triazole (prothioconazole)	3	Medium	N	14	Excellent leaf spot and white mold activity in early season band. CBR suppression in-furrow.	Rotate with alternative chemistry to reduce leaf spot resistance risk.
Propulse	Triazole (prothioconazole) + Carboxamide (fluopyram)	3 + 7	Medium to high	N	14	Excellent leaf spot and white mold activity. CBR suppression in-furrow.	Rotate with alternative chemistry to reduce leaf spot resistance risk.
Provost Silver	Triazole (prothioconazole + tebuconazole)	3	High	N	14	High control for major foliar (leaf spot) and soil (WM, Rhizoc.) diseases.	Triazoles vulnerable to leaf spot resistance. Rotate or tank-mix with other chemistry.

GUIDE TO PEANUT FUNGICIDES (Cont.)

Product	Chemistry	MOA*	Risk of leaf spot resistance	Feed hay	PHI	Strengths	Limitations
Provost Silver + Microthiol Disperss	Triazoles above + Sulfur	3 + M2	Medium to high	N	14	Microthiol Disperss 5 lb/A greatly improves leaf spot activity of Provost Opti.	Must be rotated with other chemistries.
Provysol	Triazole (mefentrifluconazole)	3	High	Y	14	Leaf spot activity, white mold suppression.	Rotate with other MOA.
Quash	Triazole (metconazole)	3	Medium	N	14	Effective against white mold.	Needs Bravo tank-mix for leaf spot control.
Revytek	Triazole (mefentrifluconazole) + Carboxamide (fluxapyroxad) + Strobilurin (pyraclostrobin)	3 + 7 + 11	Medium to high	Y	14	Systemic and highly effective foliar activity; active against soil diseases. Multiple MOA.	SC white mold data limited.
Topguard	Triazole (flutriafol)	3	Medium	N	7	Systemic leaf spot control, active against white mold.	Triazoles vulnerable to leaf spot resistance. Must be rotated or tank-mixed with other MOA.
Topsin 4.5FL	Benzimidazole (thiophanate-methyl)	1	Very high	Y	14	Adds systemic activity to Bravo. Cost effective, high risk treatment for leaf spot.	Must be tank-mixed and limited to two applications per year. Little or no soil activity.
Umbra	Triazole (flutriafol) + Carboxamide (flutolanil)	3 + 7	Medium to high	N	40	Excellent white mold and Rhizoctonia activity, some leaf spot activity.	Leaf spot control requires a tank mix partner (bravo) for effective management.
Velum	Carboxamide (fluopyram)	7	Medium to high	N	14	In-furrow suppression of leaf spot, white mold and nemts.	Rotate with other MOA.

DISEASE RESPONSE CHART FOR PEANUT FUNGICIDES

Product	Rate/A	Late leaf spot	White mold	Rhizoctonia limb rot	Cylindrocladium black rot (CBR)	Web blotch
Absolute	3.5-7 oz	Good	Poor	Good? (7 oz)	None	Good?
Alto + Bravo	5.5 oz + 1 pt	V. Good	Fair/Poor	Fair/Poor?	Poor	Good
Approach Prima	6.8 oz	Good	Fair/Poor	?	Poor	Good?
Bravo (or generics)	1.5 pt	V. Good	None	None	None	Fair
Convoy + Bravo	13-32 oz + 1.5 pt	Good	V. Good/Ex.	V. Good	None	Fair
Domark	5.25-6.9 oz	Good	None	None	None	Good?
Evito	5.7 oz	Good	Good	?	Poor	Good?
Elast	15 oz	Fair	None	None	None	None
Elatus	7.3-9.5 oz	Good/V. Good	Ex.	V. Good/Ex.?	Poor	Good
Endura	8-10 oz	Good	Fair	?	Poor	Good
Excalia	2-4 oz	Fair	Ex.	Good/V. Good?	?	?
Fontelis	16 oz	Good	Ex.	Good?	Poor	?
tebuconazole + Bravo	7.2 oz + 1-1.5 pt	V. Good	V. Good	V. Good	Poor/Fair	Good?
Headline	6-12 oz	Fair/Good	Fair (12-15 oz)	Good/V. Good?	Poor	Ex.
Lucento	5.5 oz	Good/V. Good	Good	Good?	Good?	?
Miravis	3.4 oz	Good/V. Good	None	None	None	V. Good?
Priaxor	4-8 oz	V. Good	Good/V. Good (6-8 oz)	V. Good/Ex.? (8 oz)	Poor	Good?
Priaxor + Provost Opti	4 oz + 10.7 oz	Ex.	Ex.	V. Good?	Poor/Fair	Good?
Proline	5.7 oz	Ex.	Ex.	V. Good	Good (in-furrow)	Good?
Propulse	13.6 oz	Ex.	Ex.	V. Good	V. Good/Ex. (in-furrow)	Good?
Provost Silver	13 oz	V. Good	V. Good	V. Good	Poor/Fair	Good?
Provost Opti + Microthiol Disperss	10.7 oz + 5 lb	Ex.	V. Good	V. Good	Poor/Fair	Good?
Provysol	5-7 oz	V. Good/Ex.	V. Good?	?	?	?
Quash + Bravo	3-4 oz + 1 pt	V. Good	V. Good	?	Poor?	Good?
Revytek	8-15 oz	V. Good	V. Good?	?	?	?
Topguard	7-14 oz	Fair/Good	Good	?	None	Good?
Topsin 4.5FL + Bravo	8-10 oz + 1.5 pt	V. Good ²	None	Fair?	None	Fair?
Umbra + Bravo	19-38 oz + 1 pt	V. Good	V. Good/Ex.	V. Good	None	Fair
Velum	6.5-6.8 oz	Good/V. Good	Good?	None?	None?	None?

***Ratings are based on the relative performance of the listed application rates. Effective disease control and resistance prevention requires multiple application programs with a combination of materials. None = no control; Poor = low level of control; Fair = erratic control or suppression only; Good = controls typical disease pressure; V. Good = very good: better than average disease control; Ex. = excellent: consistent superior control.**

PEANUT INSECT MANAGEMENT

Dan Anco, Extension Peanut Specialist

See the following tables for insect control recommendations, active ingredient concentrations and use precautions. In many cases, controlling peanut volunteers in rotation years helps prevent insect population buildup and damage in the following year.

Thrips cause serious crop stunting and yield loss from both direct feeding and virus transmission (tomato spotted wilt). All commercial peanuts planted in S. C. should be treated at planting with a preventative in-furrow insecticide (Thimet 20G). Admire Pro in-furrow (10 fl oz) can also be used for thrips control; however, since imidacloprid often increases virus, it benefits from being paired with highly virus-resistant varieties (e.g., Bailey, Sullivan, TifNV-High O/L). Aldicarb (AgLogic 15G) in-furrow is also effective against thrips. Immediate foliar application of Orthene is recommended if in-furrow treatment fails to prevent thrips stunting. **NOTE:** if **Velum** is used (not Velum Total), an insecticide for thrips will need to be included.

Potato leafhopper feeding causes peanut leaflets to turn yellow at the tip in a V-shaped pattern (hopperburn). This chlorotic symptom is often confused with nutrient deficiency. Hopperburn typically begins on field borders. If 15 to 20% of the entire field becomes affected and adults are still present, treat by mixing a recommended insecticide in with the next fungicide application. Bailey, Sugg, Sullivan and Wynne are particularly susceptible.

Threecornered alfalfa hoppers are green, wedge-shaped insects that feed by piercing peanut laterals, stems, and leaf petioles. The circular feeding pattern forms a girdle around the stem which blocks the flow of plant sugars. Girdles may cause the affected branch of the plant to wilt and even snap off if bent. Plants often put out above-ground (adventitious) roots at the wound site on lower stems. In SC, girdling activity increases significantly in July. The risk of economic injury is apparently greater on runner types with small plant size. Pyrethroid insecticides are effective against hoppers, but these can flare secondary pest problems like spider mites that can be more damaging.

Soil Insects:

Lesser cornstalk borers attack pods, pegs, lateral stems and the crown at the soil line during extended drought stress. Fields with lighter soils are particularly vulnerable. In addition to losses from direct injury, LCB damage is associated with increased white mold and aflatoxin levels due to the wounds it causes. Rapid canopy closure and reduced soil temperatures lower LCB risk. **Irrigation is the best defense against lesser cornstalk borer.** Late fall tillage before planting covers can help reduce but will not eliminate LCB winter survival. LCB damage is typically less severe under reduced-tillage.

Burrower bugs primarily attack reduced-tillage peanut fields under drought stress. These are essentially underground stink bugs which feed directly on kernels by piercing pods with their needle-like mouthparts. In addition to direct yield and grade loss (reduced kernel weight), burrower bug damage can lead to Seg. II loads and increased aflatoxin levels (Seg. III). **Irrigation is also the best defense against burrower bug injury.** Late fall tillage can help reduce but will not eliminate burrower bug winter survival.

Wireworms are immature or larval stages of click beetles that commonly feed on peanut pods. Although wireworms are capable of causing significant injury, thus far economic damage to peanut has been minimal under S. C. conditions. The only practical treatment for wireworms has been preventative Lorsban application, which has recently been banned by the EPA.

Southern corn rootworm is the immature stage of the eleven-spotted cucumber beetle. This worm tunnels into peanut pods under high soil moisture conditions, usually in more organic soils such as found in bottom areas, particularly under irrigation. Rootworm injury has been a relatively minor concern thus far under S. C. conditions.

Foliage Caterpillars:

Corn earworm is the most common foliage feeding insect on peanuts. Corn earworms usually appear in peanut fields during the last week of July or first week of August after the moths emerge from corn fields. Corn earworms initially feed in plant terminals, then blooms, older leaves and pegs as they mature. It is difficult to separate corn earworm from tobacco budworm with the naked eye; several non-pyrethroid products are effective on both.

Fall armyworms are not usually an economic problem on peanut, but they can occur in very high numbers during outbreak years. Infestations typically occur in mid-August, a couple weeks after corn earworms first appear.

Granulate cutworm can defoliate small plants in June. Granulate cutworms have distinctive Chevron or “sergeant stripe” markings along the back. Granulate cutworms initially feed on blooms, then leaves, pegs and pods as they mature. During the day cutworms can be found curled up under shed leaves and other organic matter on the soil surface. The larvae climb up the plant at night to feed. Symmetrical feeding damage (from feeding when the leaves are folded at night) is a clue to look for granulate cutworms on and in the soil.

Velvetbean caterpillars can rapidly defoliate late maturing peanuts during early August to October in southern coastal plain counties of S. C, especially Jasper, Hampton, Allendale and Colleton counties. Velvetbean caterpillars range from light green to almost black. A key characteristic is medium to large worms thrash violently when handled. Moths land with their wings out and have a line that stretches wing tip to wing tip. They are easy to control.

Scouting for Foliage Caterpillars:

Use a 3' shake cloth to look for worms starting the last week of July. Work the dowel handle up under lateral stems to the plant crown and bend the other side of the plants over the cloth. Beat down vigorously 15 times to knock worms onto the cloth. Shake the plants, bend them back out of the way and count the worms on the cloth. Also count worms under the cloth on both sides of the row to calculate worms/row ft. Check at least three areas/field.

Rank-growing, unstressed peanuts with a closed canopy can tolerate 8 foliage feeding worms per row ft. The treatment threshold is 4 worms per row ft on stressed plants which have not lapped the middle. Runner varieties with slow growing canopies can be more susceptible to direct injury from foliage feeding. Weed control may also be affected by delayed canopy closure on runner varieties. **Irrigation, vigorous canopy growth, and avoidance of unnecessary early season insecticide applications are the best defense against foliage-feeding worms.**

Spider mites can damage drought stressed peanuts in August and September. Stressed fields should be spot checked for yellow “hits” indicating where mites are feeding. Spider mites can be seen with a hand lens on the underside of leaflets. Webbing may be present with heavy infestation. These twospotted spider mites get their name from the two spots (one on each side) on their body. Mite suppression requires ground application, thorough coverage, and potentially a second application in 5-7 days. Pyrethroid application greatly increases the risk of mite outbreaks. **Irrigation is the best defense against spider mite injury.**

PEANUT INSECT CONTROL

Sucking/Piercing/Rasping Pests			
Insect	Product	Rate/A	Comments
Thrips In-furrow	Thimet 20G	4.7 lb (38" rows)	Preventative in-furrow thrips control is a must on all peanuts planted in S.C.
	Admire Pro	10 fl oz	Maximum labeled Thimet rate is 5.5 oz/1,000 row ft, equivalent to 4.7 lb/A on 38", 5.0 lb on 36", and 6.0 lb on 30" rows. Twin rows: use 3.5 oz/1,000 row ft in each row, which equals 6.0 lb/A on 38" centers. Admire Pro and generic imidacloprid control thrips but usually increase tomato spotted wilt virus. Pair with highly virus-resistant varieties (e.g., Bailey, Sugg, Sullivan). Twin rows: maximum labeled rate for Admire Pro is 10.5 fl oz/A/season. Splitting 5 fl oz into each row will usually require follow up with foliar Orthene for adequate thrips suppression.
	AgLogic 15G	7 lb	
Thrips Foliar	Orthene 75S	0.5-1.0 lb	Apply foliar Orthene immediately if in-furrow treatments do not prevent thrips stunting. Diamond suppresses immature thrips; it will not control adults. Exirel at cracking for thrips suppression.
	Orthene 97SP	0.375-0.75 lb	
	Diamond 0.83EC	6-12 fl oz	
	Radiant SC	1.5-3 fl oz	
	Exirel 0.83 SE	13.5-20.5 fl oz	
Leafhoppers	Besiege 1.25 SC*	5.0-8.0 fl oz	Hopperburn starts on field borders usually in June - July. Treat if hopperburn is spreading across the field and approaching 15-20% symptomatic leaflets. Bailey and Sugg varieties are particularly susceptible to hopperburn. *Besiege is a pyrethroid + diamide mix. For control of both hoppers and worms, use worm rates below.
	Orthene 75S	0.6-1.0 lb	
	Orthene 97SP	0.5-0.75 lb	
	Pyrethroids		
	Asana XL 0.66EC	3.9 fl oz	
	Baythroid XL 1EC	1.0-1.8 fl oz	
	Brigade 2EC	2.1-6.4 fl oz	
	Declare 1.25CS	1-1.5 fl oz	
	Mustang Max 0.8EC	1.75-4 fl oz	
Proaxis 0.5CS	1.9-3.2 fl oz		
Spider mites	Comite II	2.25 pt	Use ground application, 20 gal/A at 40-60 psi. <u>Comite/Omite</u> : repeat appl. after 5-7 days. Pyrethroids can cause mite outbreaks. Avoid unnecessary worm insecticides to reduce mite risk. Irrigation is the best mite defense. Use of pyrethroids labeled for spider mite control (e.g., Danitol) is <u>not</u> recommended.
	Omite 30WS	3-5 lb	
	Portal	1-2 pt	
Three-cornered alfalfa hopper	Besiege 1.25 SC*	5.0-8.0 fl oz	Treat at 45-60 days after planting to prevent injury. *Besiege is a pyrethroid + diamide mix. For control of both hoppers and worms, use worm rates below.
	Orthene 75S	0.65 lb	
	Orthene 97SP	0.5 lb	
	Pyrethroids		
	Baythroid XL 1EC	1.8-2.4 fl oz	
	Brigade 2EC	2.1-6.4 fl oz	
Declare 1.25CS	0.8-1.3 fl oz		

Foliage Feeding Worms

Insect	Product	Rate/A	Comments
Beet armyworm, Fall armyworm, Soybean looper	Besiege 1.25 SC	6-10 fl oz	Unstressed plants with a large, closed canopy can tolerate 8 total worms/row ft. Treat if populations reach 4/row ft on drought stressed, unlapped peanuts. Fall armyworm attacks peanut in outbreak years from mid-August to early September. Loopers seldom significantly defoliate peanuts by themselves but typically occur with other defoliators. If Besiege or Coragen are used for loopers or beet armyworms, use the maximum labeled rate. Exirel not labeled for beet armyworm.
	Blackhawk 36 WDG	1.7-3.3 oz	
	Coragen 1.67 SC	3.5-5.0 fl oz	
	Diamond 0.83EC	6-12 fl oz	
	Exirel 0.83 SE	13.5-20.5 fl oz	
	Intrepid Edge 3F	4-8 fl oz	
	Prevathon 0.43 SC	14-20 fl oz	
	Radiant 1 SC	3-8 fl oz	
	Steward 1.25 SC	9.2-11.3 fl oz	
	Vantacor 5 SC	1.2-2.5 fl oz	
Corn earworm	Besiege 1.25 SC	6-10 fl oz	Same threshold as for beet armyworm. Peanuts can often withstand significant defoliation (at least 30%) prior to pegging. We have not measured any yield response to treating early season earworm infestations. However, weed control on small canopy runners may be affected by delayed canopy closure. Corn earworm is difficult to separate from tobacco budworm with the naked eye; several non-pyrethroid products are effective against both.
	Blackhawk 36 WDG	1.7-3.3 oz	
	Coragen 1.67 SC	3.5-5.0 fl oz	
	Exirel 0.83 SE	10-20.5 fl oz	
	Intrepid Edge 3F	4-8 fl oz	
	Lannate 2.4 LV	12-18 fl oz	
	Lannate 90 SP	0.25-0.38 lb	
	Prevathon 0.43 SC	14-20 fl oz	
	Radiant 1 SC	3-8 fl oz	
	Steward 1.25 SC	9.2-11.3 fl oz	
	Vantacor 5SC	1.2-2.5 fl oz	
	Pyrethroids		
	Asana XL 0.66 EC	3.9-5.8 fl oz	
	Baythroid XL 1EC	1.8-2.4 fl oz	
	Brigade 2 EC	2.1-6.4 fl oz	
	Danitol 2.4 EC	10.6-16 fl oz	
	Declare 1.25 CS	1.0-1.5 fl oz	
Karate Z 2.08CS	1.3-1.9 fl oz		
Mustang Max 0.8EC	3.2-4 fl oz		
Proaxis	2.5-3.8 fl oz		
Tobacco budworm	Besiege 1.25 SC	6-10 fl oz	Same threshold as for beet armyworm. Peanuts can withstand significant defoliation (at least 30%) prior to pegging. We have not measured any yield response to treating early season budworm infestations. However, weed control on small canopy runners may be affected by delayed canopy closure. See corn earworm comment.
	Blackhawk 36 WDG	1.7-3.3 oz	
	Coragen 1.67 SC	5.0 fl oz	
	Exirel 0.83 SE	10-20.5 fl oz	
	Intrepid Edge 3F	4-8 fl oz	
	Prevathon 0.43 SC	14-20 fl oz	
	Steward 1.25 SC	9.2-11.3 fl oz	
Vantacor 5 SC	1.2-2.5 fl oz		
Velvetbean caterpillar	Besiege 1.25 SC	5-8 fl oz	Velvetbean caterpillar is a late season pest (Sep - Oct) that can defoliate peanuts quickly. This pest is usually easy to control but often misidentified as an armyworm, leading to unnecessary treatment cost. Adding Dimilin 2L (2 fl oz/A) to the last fungicide treatment will prevent VBC in high risk areas (southern coastal plain counties). Do not use Dimilin to control established populations. Note: Steward is one of the few insecticides that <u>will not</u> control velvetbean caterpillar.
	Blackhawk 36 WDG	1.7-3.3 oz	
	Coragen 1.67 SC	3.5-5.0 fl oz	
	Diamond 0.83EC	6-8 fl oz	
	Dimilin 2L	2.0 fl oz	
	Intrepid Edge 3F	4-8 fl oz	
	Prevathon 0.43 SC	14-20 fl oz	
	Radiant 1 SC	3-8 fl oz	
	Vantacor 5 SC	1.2-2.5 fl oz	

Foliage Feeding Worms (cont.)

Insect	Product	Rate/A	Comments
Velvetbean caterpillar (continued)	Pyrethroids		Velvetbean caterpillar is a late season pest (Sep - Oct) that can defoliate peanuts quickly. This pest is usually easy to control but often misidentified as an armyworm, leading to unnecessary treatment cost. Adding Dimilin 2L (2 fl oz/A) to the last fungicide treatment will prevent VBC in high risk areas (southern coastal plain counties). Do not use Dimilin to control established populations. Note: Steward is one of the few insecticides that <u>will not</u> control velvetbean caterpillar.
	Asana XL 0.66 EC	3.9-5.8 fl oz	
	Baythroid XL 1EC	1.8-2.4 fl oz	
	Brigade 2 EC	2.1-6.4 fl oz	
	Danitol 2.4 EC	10.6-16 fl oz	
	Declare 1.25 CS	1.0-1.5 fl oz	
	Karate Z 2.08 CS	1.3-1.9 fl oz	
	Mustang Max 0.8EC	1.3-4 fl oz	
Proaxis 0.5 CS	2.5-3.8 fl oz		

Soil Insects

Lesser cornstalk borer, Southern corn rootworm,	Lesser cornstalk borer and southern corn rootworm: Besiege 1.25 SC	10 fl oz	Lesser cornstalk borer injury only occurs under severe drought stress. Irrigation is the best defense against burrower bug or lesser cornstalk borer injury. Besiege, Diamond, Exirel, Prevathon, or Vantacor for lesser cornstalk borer – apply at first signs of feeding before pests reach damaging levels.
	Lesser cornstalk borer only: Diamond 0.83EC	6-12 fl oz	
	Exirel 0.83 SE	13.5-20.5 fl oz	
	Prevathon 0.43 SC	14-20 fl oz	
	Vantacor 5 SC	1.2-2.5 fl oz	
Granulate cutworm	Besiege 1.25 SC	8-10 fl oz	Treat if defoliation exceeds 30% on small plants in June or about 50-55 DAP. Granulate cutworms are now resistant to pyrethroids.
	Coragen 1.67 SC	4-5.0 fl oz	
	Exirel 0.83 SE	13.5-20.5 fl oz	
	Prevathon 0.43 SC	20 fl oz	
	Steward 1.25 SC	9.2-11.3 fl oz	
Vantacor 5 SC	1.7-2.5 fl oz		
Note: there are many generic insecticide brands, particularly for pyrethroids. For equivalent rates compare active ingredient concentrations to the following table. Also see pre-harvest interval and use precautions. The label is the law. Always read and follow all pesticide label restrictions.			

PEANUT INSECTICIDE ACTIVE INGREDIENTS & USE PRECAUTIONS

Active ingredient	Brand name and formulation	IRAC* Group	PHI (Days)	Comments
Acephate	Orthene 75S Orthene 97SP	1B	14	Do not feed or graze.
Aldicarb	AgLogic 15G	1A	90	Do not feed or graze. Do not exceed 17 lb/A/season.
Chlorpyrifos	Lorsban 15G	1B	21	Use discontinued by EPA.
Diamides				
Chlorantraniliprole	Coragen 1.67 SC	28	1	Do not exceed 4 appl. per season or 0.2 lb a.i. of chlorantraniliprole per acre/season.
	Prevathon 0.43 SC	28	1	
	Vantacor 5 SC	28	1	
Chlorantraniliprole + lambda-cyhalothrin	Besiege 1.25 SC	28 3A	14	Do not exceed 31 oz/A/season.
Cyantraniliprole	Exirel 0.83 SE	28	14	Do not exceed 0.4 lb a.i. per acre per year.
Diflubenzuron	Dimilin 2L	15	28	Do not exceed 3 appl. per season.
Fenpyroximate	Portal	21A	1	Do not exceed 2 appl. per season.
Imidacloprid	Admire Pro 4.6F	4A	14	Increases tomato spotted wilt virus; use only on highly resistant varieties. Do not feed or graze.
	Velum Total 2.17F			
Indoxycarb	Steward 1.25 SC	22	14	Do not exceed 45 fl oz/A/season.
Methomyl	Lannate 2.4 LV	1A	21	Do not feed or graze.
	Lannate 90 SP			
Methoxyfenozide + spinetoram	Intrepid Edge 3F	18 5	7	Do not exceed 3 appl./season. Max 1 lb methoxyfenozide or 0.188 lb spinetoram/A/season. Do not feed or graze.
Novaluron	Diamond 0.83EC	15	28	Do not exceed 36 fl oz/A/season. Do not feed or graze.
Phorate	Thimet 20G	1B	90	Do not exceed 5.5 oz/1000 row ft or 7.5 lb/A. Do not feed or graze.
Propargite	Comite II 6 EC	12C	14	Do not exceed 2 appl. per season. Do not feed or graze.
	Omite 30WS			
Pyrethroids				
Beta cyfluthrin	Baythroid XL 1 EC	3A	14	Do not exceed 0.066 lb ai/A/season.
Bifenthrin	Brigade 2 EC		14	Do not exceed 0.5 lb ai/A/season. Do not feed or graze.
Esfenvalerate	Asana XL 0.66 EC		21	Do not feed or graze.
	Danitol 2.4 EC		14	Do not feed forage or hay within 14 days of treatment. Do not exceed 2.66 pt/A/season.
Gamma-cyhalothrin	Declare 1.25 CS Proaxis 0.5 CS		14	Do not exceed 0.38 pt/A (Declare) or 0.96 pt/season (Proaxis).
Lambda-cyhalothrin	Karate Z 2.08 CS		14	Do not feed or graze.
Zetamethrin	Mustang Max 0.8EC		7	Do not exceed 0.15 lb ai/A/season. Do not feed or graze.
Spinetoram	Radiant 1 SC	5	3	Do not exceed 3 appl. per season. Do not feed or graze.
Spinosad	Blackhawk 36 WDG	5	3	Do not exceed 9 fl oz/A/season.

*IRAC group number (Insecticide Resistance Action Committee) indicates mode of action. Repeated pest exposure to the same mode of action increases the risk of insecticide resistance.

Note: there are many generic insecticide brands, particularly for pyrethroids. For equivalent generic rates compare active ingredient concentrations to this table. The label is the law. Always read and follow all pesticide label restrictions.

PEANUT NEMATODE CONTROL

John D. Mueller, Extension Plant Pathologist
Dan Anco, Extension Peanut Specialist

Nematodes have been a relatively minor problem on peanuts in South Carolina. Peanut root-knot (race 1) nematode is capable of causing severe losses, but economic injury has been very rare. Lesion nematode frequently causes hull injury on green peanuts and can cause yield reduction under extremely high populations. Sting nematode is rarely found in peanut fields in South Carolina, but when observed damage can be severe even at relatively low populations. Hull injury from nematode infection can also lead to increased fungal colonization and disease of pods.

Nematode management is not recommended for peanuts in South Carolina unless injury or damage to peanuts has been documented. Crop rotation and resistance are the most economical and desired management strategies for minimizing nematode problems. A nematode resistant variety (Georgia 14N, Tifguard, TifNV-High O/L) is recommended for fields with a documented history of peanut root-knot nematode injury on peanut. A fumigant like Telone II (field-wide: 6 – 9 gal/A, in-row: 4.5 – 6 gal/A) or Vapam HL (6.61 fl oz/100 linear row ft) applied 2 weeks at a depth of 12” prior to planting can be used to suppress nematodes. Alternatively, Velum (6.5 fl oz/A) can be applied in-furrow or through root-zone chemigation to manage nematodes near the taproot. Propulse (13.6 fl oz/A) can be applied at pegging (~45 DAP) to manage nematodes in the fruiting zone but must be watering in to be effective (0.10 – 0.25 in/A water). AgLogic 15G (aldicarb) (7 lb/A at-planting, with an optional pegging application at 10 lb/A) may also be used for nematode management. See later sections for product efficacy on thrips, disease management.

Peanuts are an excellent rotation crop to suppress Reniform, Southern Root-knot and Columbia lance nematodes in cotton.

Field Crop Hosts for Common Nematodes

Crop	Root-knot				Lesion	Lance	Soybean cyst	Sting	Ring	Reniform
	Southern	Peanut race 1	Peanut race 2	Northern						
Peanut	-	+	-	+	+	-	-	±	+	-
Cotton	+	-	-	-	+	+	-	+	+	+
Corn	+	+	+	+	+	+	-	+	±	-
Soybean	+	+	+	+	+	+	+	+	±	+
Tobacco	+	+	+	+	+	-	-	-	+	+
Small grain	+	+	+	+	+	+	-	+	+	-
Grain sorghum	+	+	+	?	+	?	-	+	-	-
Tomato	+	+	+	+	+	-	-	+	+	?

+ indicates host; - indicates non-host; ± indicates host reaction can vary based on population.

Adapted by J. D. Mueller from: Powell, W. M. 1990. Plant susceptibility to major nematodes in Georgia. Univ. of Georgia Extension Bulletin 904; and Dickerson, O. J., J. H. Blake, and S. A. Lewis. 2000. Nematode guidelines for South Carolina. Clemson Univ. Extension Circular 703.

WEED CONTROL IN SMALL GRAINS

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Small Grains

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>flumioxazin</i>		0.064 lb	14	--	12 hours
Valor SX 51WDG	2.0 oz				
Valor EZ 4SC	2.0 fl oz				
Comments: <i>VALOR SX</i> is labeled for preplant use in wheat only. For preplant weed control use only in no-till or minimum tillage fields where previous year's crop residue has not been incorporated into the soil. Plant wheat no sooner than 7 days after VALOR SX application. Do not irrigate between emergence and spike growth stage. Wheat must be planted a minimum of 1 inch deep. Do not graze until wheat has reached 5 inches in height. Do not apply more than 2.0 oz/A of VALOR SX during a single growing season.					
<i>glyphosate</i> (various)	22-32 fl oz	0.76-1.13 lb ae	9	7 days	4 hours
Comments: Labeled for preplant use in oats, wheat, barley, and rye. Apply 2 to 4 weeks before planting date to control existing summer annual grass and broadleaf weeds and reduce competition with small grain seedlings.					
<i>glyphosate</i> (various)	22-32 fl oz	0.76-1.13 lb ae	9	45 days	4 hours
+					
<i>thifensulfuron</i>		0.0094-0.0188	2		
+		+			
<i>tribenuron</i>		0.0047-0.0094	2		
Harmony Extra SG	0.45-0.9 oz				
Comments: <i>Harmony Extra SG</i> labeled for preplant burndown use in wheat, triticale, and barley only. GLYPHOSATE + HARMONY EXTRA SG may be used as a burndown treatment prior to, or shortly after planting (but before crop emergence). Consult glyphosate product to determine if an adjuvant is needed. If an adjuvant is needed, then add NIS (80% active or greater) at 1 qt/100 gallons of spray solution plus urea ammonium nitrate (28-32% N) or ammonium sulfate (AMS) at 2 lb/A.					
<i>paraquat</i> 2S	2.0-4.0 pt	0.5-1.0 lb	22	60 days	24 hours
<i>paraquat</i> 3S	1.7-2.7 pt	0.64-1.01 lb			
Comments: Labeled for preplant use in barley and wheat only. GRAMOXONE is a RESTRICTED USE PESTICIDE. Add non-ionic surfactant at 1 pt per 100 gal of spray solution or crop oil concentrate at 1 gal per 100 gal of spray solution. If weed density is high, use a higher spray volume to ensure complete coverage of the weeds. Use the higher rates for larger weeds.					
<i>saflufenacil</i>		0.022-0.045 lb		30 days	12 hours
Sharpen 2.85 SC	1.0-2.0 fl oz		14		
Comments: <i>SHARPEN</i> is labeled for preplant use in wheat, oats, barley, rye, and triticale. Apply SHARPEN for early burndown and/or limited residual control of broadleaf weeds. For optimum burndown activity, add methylated seed oil (MSO) at 1 gal per 100 gal plus ammonium sulfate (AMS) at 8.5 to 17 lbs per 100 gals or urea ammonium nitrate (UAN) at 1.25 to 2.5 gals per 100 gals of spray volume. Do not apply more than 4.0 fl oz/A of SHARPEN per cropping season.					

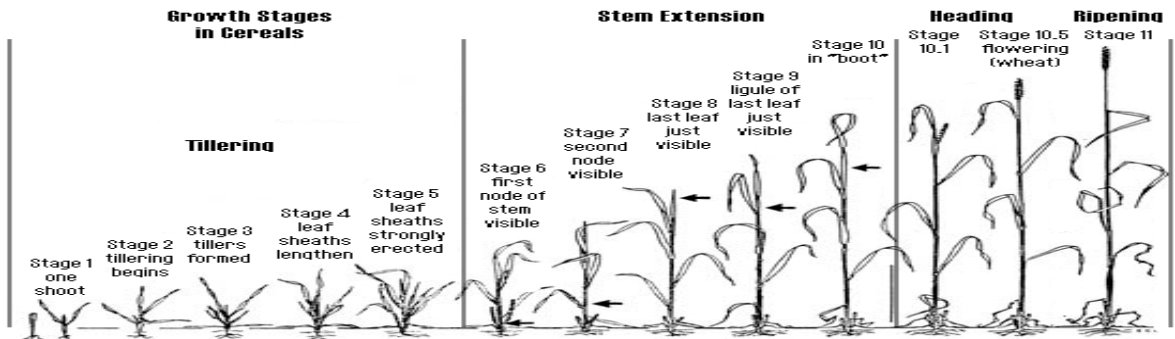
Weed Response to Herbicides for Small Grain Weed Management¹

	PRE		POSTEMERGENCE																				
	Anthem FLEX	Sharpen	Anthem FLEX	Axial XL	Axiom	Banvel/Clarity	Beyond ²	Express	Fierce	Finesse	Harmony Extra	Huskie	MCPA	Osprey	Peak	PowerFlex HL	Quelex	Sentrallas	Starane Ultra	Valor SX	WideMatch	Zidua	2,4-D
barley, little	G	P	G	P	G	P	G	P	---	---	P	P	P	---	P	---	P	P	P	---	P	---	P
bluegrass, annual	G	P	G	P	G	P	G	P	---	P	P	P	P	GE	P	P	P	P	P	---	P	---	P
buttercup	---	---	---	P	---	F	P	---	---	G	GE	G	---	---	G	---	G	---	---	---	G	---	G
cheat	F	P	F	P	E	P	G	P	---	---	P	P	P	P	P	FG	P	P	P	---	P	---	P
chickweed, common	F	F	GE	P	G	G	F	G	GE	G	FG	GE	P	F	G	FG	E	GE	GE	GE	GE	GE	P
cornflower	---	---	---	P	---	FG	---	---	---	F	P	---	---	P	G	P	G	G	---	---	G	---	G
cudweed	---	---	---	P	G	GE	G	---	---	---	E	GE	GE	---	---	---	E	---	---	---	GE	---	GE
dock, curly	P	---	---	P	P	F	P	E	FG	---	E	G	P	P	---	P	---	G	---	F	F	---	P
eveningprimrose, cutleaf	---	---	G	P	GE	G	---	F	FG	---	F	GE	E	P	G	P	---	F	---	FG	G	G	E
garlic, wild	P	---	---	P	P	F	P	P	P	E	P	P	P	GE	P	---	P	P	---	P	---	F	F
geranium, Carolina	---	---	---	P	F	G	G	G	---	GE	G	---	G	---	---	---	G	G	---	---	G	---	F
henbit	G	F	GE	P	GE	F	G	F	GE	G	G	GE	P	G	GE	FG	E	F	F	GE	G	GE	P
horseweed	---	G	GE	P	---	GE	---	F	GE	---	F	GE	F	P	---	P	E	F	F	GE	GE	GE	G
knawel	---	---	---	P	---	G	---	---	---	---	G	---	---	---	---	---	G	GE	---	---	---	---	P
mustard, wild	P	G	GE	P	G	F	F	G	GE	G	E	GE	GE	GE	GE	GE	GE	G	F	G	F	GE	GE
pepperweed, Virginia	---	---	G	P	---	F	---	---	GE	---	G	GE	---	---	---	---	GE	---	---	G	---	G	E
pennycress, field	---	---	---	P	---	F	---	F	---	G	G	GE	---	GE	G	---	G	---	F	---	F	---	G
radish, wild	P	---	GE	P	G	F	F	F	GE	G	E	GE	GE	G	GE	GE	P	F	---	G	F	GE	GE
ryegrass, Italian	E	P	E	E	G	P	G	P	E	F	P	P	P	E	P	E	P	P	P	E	P	E	P
ACCase-resistant	E	P	E	P	G	P	G	P	E	F	P	P	P	E	P	E	P	P	P	E	P	E	P
ALS-resistant	E	P	E	E	G	P	G	P	E	P	P	P	P	P	P	P	P	P	P	E	P	E	P
shepherdspurse	---	---	GE	P	---	FG	---	G	GE	G	E	GE	GE	---	GE	---	E	G	---	G	P	GE	GE
spurry, corn	---	---	---	---	P	GE	---	GE	GE	---	GE	---	---	---	---	---	F	---	---	---	---	---	G
swinecress	---	---	---	P	G	---	---	---	---	---	E	GE	G	E	---	---	E	G	---	---	---	---	G
thistles	---	---	---	P	G	GE	G	---	---	GE	FG	E	G	---	GE	---	E	---	F	---	GE	---	G
vetch	---	---	---	P	G	E	P	F	---	GE	P	E	---	PF	---	P	E	---	---	---	GE	---	G

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = less than 70% control; --- = Insufficient Data.

²Use only on Clearfield wheat varieties.

Feekes Growth Stages of Cereals:



Preemergence/Early POST Herbicides for Weed Management in Small Grains

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>flufenacet</i> +		0.14-0.27 lb	15	30 days	12 hours
<i>metribuzin</i> Axiom 68 WDG	4.0-8.0 oz	0.03-0.07 lb	5		
Comments: <i>Labeled for wheat only.</i> AXIOM contains metribuzin, which may injure certain wheat varieties, consult label for details. Apply AXIOM from spike to 2-leaf growth stage. Wheat must be planted at a depth of 1.0-2.0 in or injury may occur. Controls henbit, wild radish, chickweed, ryegrass, and annual bluegrass. Activity on annual ryegrass is good (up to the 1 leaf growth stage), depending on timely rainfall after application. For sequential applications, do not apply more than 10 oz/A of AXIOM per growing season. Do not graze winter wheat within 30 days of an Axiom application.					
<i>flumioxazin</i> +		0.040 lb	14	---	12 hours
<i>pyroxysulfone</i> Fierce 76 DF	1.5 oz	0.031 lb	15		
Comments: <i>Labeled for wheat only.</i> Apply FIERCE when 95% of wheat is in the spike to 2-leaf growth stage. Controls emerged ryegrass up to 0.5 in in height. Wheat must be planted a minimum of 1.0 in deep or crop injury may occur. Do not apply to fields where wheat seed has been broadcast and shallow incorporated. Do not tank mix FIERCE with any adjuvant, fertilizer, or other pesticide or severe wheat injury will occur. Apply FIERCE in 10 to 15 gallons per acre of water to ensure adequate coverage of emerged ryegrass. Do not apply more than 1.5 oz/A of FIERCE per growing season.					
<i>pyroxysulfone</i> Zidua 85 WG Zidua SC 4.17SC	1.25-2.5 oz 1.25-4.0 fl oz	0.053-0.133 lb 0.041-0.130 lb	15	7 days	12 hours
Comments: <i>Labeled for wheat only.</i> Apply ZIDUA when wheat is in the early spike (at least 0.5 in shoot) to 4 th tiller growth stage. Do not apply ZIDUA early preemergence (0.5 in shoot to full spike stage) to broadcast seeded wheat fields. Do not irrigate after a ZIDUA application during the early spike growth stage until wheat is at the full spike stage. Do not plant wheat deeper than 1.5 inches before an early preemergence application of ZIDUA. Do not apply ZIDUA to flood prone fields or fully saturated soils. Do not apply more than 0.133 lb ai/A of <i>pyroxasulfone</i> per growing season. Wheat forage or hay can be grazed or fed 7 days after application.					
<i>pyroxasulfone</i> +		0.058-0.131 lb	15	7 days	12 hours
<i>carfentrazone</i> Anthem FLEX 4SE	2.0-4.5 fl oz	0.004-0.009 lb	14		
Comments: <i>Labeled for wheat only.</i> Apply ANTHEM FLEX after planting up to the 4 th tiller growth stage. Wheat must be planted at least 1 inch deep but not more than 1.5 inches. Use rate depends on soil texture, use lower rate on coarse soils, consult label for details. Preemergence use (right after planting and before crop emergence) may result in stunting or stand loss if heavy rainfall results in soil saturation during emergence and early seedling development. Effective on little barley, annual bluegrass, rattail fescue, and annual ryegrass. Do not apply preplant incorporated in wheat. Do not apply more than 4.55 fl oz/A of ANTHEM FLEX per cropping season. Do not apply preplant, preemergence, or early postemergence to broadcast seeded wheat. Do not harvest, feed, or graze treated wheat within 7 days of application of ANTHEM FLEX. Do not irrigate after a preemergence or delayed preemergence application until the spike growth stage. Do not apply ANTHEM FLEX to saturated or flooded soils. Do not apply preemergence if more than ¼ inch of rainfall is expected within 48 hours of application. Rainfast interval = 1 hour.					
<i>saflufenacil</i> Sharpen 2.85 SC	1.0-2.0 fl oz	0.022-0.045 lb	14	30 days	12 hours
Comments: <i>SHARPEN is labeled for use in wheat, oats, barley, rye, and triticale.</i> Apply SHARPEN right after planting small grains for controlling emerged broadleaf weeds and/or limited residual control of broadleaf weeds. Do not apply after crop emergence. For optimum activity of emerged weeds, add methylated seed oil (MSO) at 1 gal per 100 gal plus ammonium sulfate (AMS) at 8.5 to 17 lbs per 100 gals or urea ammonium nitrate (UAN) at 1.25 to 2.5 gals per 100 gals of spray volume. Do not apply more than 4.0 fl oz/A of SHARPEN per cropping season.					

Postemergence Herbicides for Weed Management in Small Grains

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>chlorsulfuron</i> +		0.0078-0.0156 lb	2	None	4 hours
<i>metsulfuron</i> Finesse 75 WDG	0.2-0.4 oz	0.0016-0.0031 lb	2		
Comments: <i>Labeled for wheat and barley only.</i> Apply FINESSE from the 1-leaf stage up to just before the boot stage. Add NIS at 0.125 to 0.5% v/v (0.5 to 2 qt per 100 gal of spray solution). Do not apply FINESSE within 60 days of an in-furrow organophosphate insecticide application. Plant only STS-soybeans following wheat/barley harvest. Do not apply more than one application of FINESSE per growing season. Do not use low rates of liquid nitrogen fertilizer solution as a substitute for surfactant (NIS). Rainfast interval = 6 hours.					
<i>clopyralid</i> +		0.09375-0.125 lb	4	40 days (grain/straw)	12 hours
<i>fluroxypyr</i> WideMatch 1.5EC	1.0-1.33 pt	0.09375-0.125 lb	4		
Comments: <i>Labeled for wheat, barley, and oats.</i> Apply from the 3-leaf growth stage up to flag leaf emergence. For control of weeds (less than 4 inches tall), such as chickweed, red sorrel, and thistles. Do not apply more than 1.33 pt of WIDEMATCH per acre per growing season. Apply to susceptible weeds before they reach 4 inches tall or vining. Do not allow livestock to graze treated areas or harvest treated forage within 7 days of application. WIDEMATCH may be tank mixed with other products labeled for postemergence applications in wheat, barley, and oats. Do not apply under conditions which favor drift onto nearby, sensitive crops. Rainfast interval = 6 hours.					
<i>dicamba</i> Banvel/Clarity 4SL	2.0-4.0 fl oz	0.0625-0.125 lb	4	7 days (grain/hay/forage)	24 hours
Comments: <i>Labeled for wheat, barley, and oats.</i> Apply BANVEL or CLARITY after tillering but before crop reaches the jointing growth stage. Do not tank mix 2,4-D with BANVEL or CLARITY in oat. Best results are obtained if applied when daytime temperatures are above 50 F. Applications of BANVEL or CLARITY to small grains during periods of rapid growth may result in crop leaning. This condition is temporary and will not impact yields. Liquid nitrogen may be used as the carrier. Rainfast interval = 4 hours.					
<i>fluroxypyr</i> Starane Ultra 2.8EC	0.3-0.4 pt	0.105-0.14 lb	4	40 days (grain/straw)	24 hours
Comments: <i>Labeled for wheat, barley, oats, and triticale.</i> Apply STARANE ULTRA from the 2-leaf growth stage up to and including flag leaf emergence for control of broadleaf weeds, such as chickweed and bedstraw. STARANE ULTRA provides suppression of mustard and marestail. Tank mix with 2,4-D or MCPA for improved control of mustards and marestail. Apply to susceptible weeds before they reach 8 inches tall or vining. Do not allow livestock to graze treated areas or harvest treated forage within 7 days of application. Do not apply STARANE ULTRA within 14 days of cutting for hay. Do not apply more than 0.7 pint per acre of STARANE ULTRA per season. Do not apply under conditions which favor drift onto nearby, sensitive crops. Rainfast interval = 1 hour.					

Postemergence Herbicides for Weed Management in Small Grains (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>halauxifen-methyl</i> + <i>florasulam</i> Quelex 20DF		0.00047 lb + 0.00047 lb 0.75 oz	2 4	60 days (grain)	12 hours

Comments: *Labeled for wheat, barley, and triticale.* Apply QUELEX from the 2-leaf growth stage up to flag leaf emergence. Target the QUELEX application when broadleaf weeds are actively growing and in the 2 to 4 leaf growth stage (less than 4 inches tall or diameter). Applications during warm, wet conditions will enhance QUELEX activity on broadleaf weeds; however, cold and/or dry conditions may result in erratic control and subsequent weed regrowth. QUELEX may be applied in a fluid fertilizer spray solution (nitrogen). Use a non-ionic surfactant at a maximum rate of 0.25 %v/v when applying QUELEX in a liquid nitrogen carrier solution. Do not apply more than 0.75 oz of QUELEX per acre per growing season. Do not apply QUELEX within 21 days of cutting small grains for hay. Do not allow livestock to graze on treated crops for 7 days following application of QUELEX. Do not use compost plant material from the treated area. **Rainfast interval = 4 hours.**

<i>imazamox</i> Beyond 1 AS		0.031-0.047 lb 4.0-6.0 fl oz	2	0 days	4 hours
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Comments: **FOR USE ONLY on CLEARFIELD and CLEARFIELD PLUS WHEAT VARIETIES!** Apply BEYOND early postemergence when weeds are actively growing from the two to four leaf stage to control wild radish and henbit. BEYOND will provide limited suppression of emerged Italian ryegrass but does not provide residual control of Italian ryegrass. Apply with NIS at 1 qt per 100 gal of spray solution and a nitrogen fertilizer solution such as UAN at 1-2 qt/A or AMS at 1.5-3 lbs/A. Do not apply BEYOND to CLEARFIELD or CLEARFIELD PLUS wheat when cold temperatures (<40 F maximum daily temperatures) are expected within 1 week of application. Do not apply more than 8 oz/A per season. Do not make sequential applications of BEYOND less than 14 days apart because of increased potential for crop response. **Rainfast interval = 1 hour.**

<i>MCPA amine 4L</i>	0.5-1.0 pt	0.25-0.5 lb	4	7 days	48 hours
<i>MCPA ester 4L</i>	0.5-1.0 pt	0.25-0.5 lb			

Comments: *Labeled for wheat, barley, oats, and rye.* For control of winter weeds, such as wild mustard, wild, and shepherdspurse apply after crop has reached to 3- to 4-leaf stage up to the boot stage. Do not graze or harvest forage on treated areas within 7 days of slaughter. **Rainfast interval = N/A (suggest 1 hour).**

<i>mesosulfuron</i> Osprey 4.5SC		0.013 lb 4.75 oz	2	60 days (grain/straw/hay)	4 hours
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Comments: *Labeled for wheat only.* For control ACC-ase annual ryegrass and other broadleaf weeds. Applications may be made from time of emergence up to the jointing stage of development. Apply with NIS at 2 qt/100 gal and UAN at 1-2 qt/A or AMS at 1.5-3 lb/A. MSO at a rate of 1.5 pt/A in a minimum of 10 gallons carrier per acre may be substituted for the NIS and nitrogen additives. OSPREY may be applied in a fertilizer solution; however, nitrogen must not exceed 15% of the total volume (1.5 gallons of Nitrogen in 10 gallons of spray solution). A NIS at 1 qt/100 gal is required for fertilizer carrier applications. The use of a fertilizer/water carrier will increase potential for crop response. Tank mix partners include MCPA, BUCTRIL, EXPRESS, FINESS, HARMONY EXTRA, STRATEGO, TILT, TOPSIN M, WARRIOR, SEVIN XLR, Z-CYPE. Do not apply more than 4.75 oz/A per season. Do not apply OSPREY within 30 days of harvest wheat for forage. Do not tank mix and apply OSPREY with MALATHION, MANCOZEB, DI-SYSTON, or METHYL PARATHION insecticides. *ALS-resistant (MOA=2) Italian ryegrass populations are present in South Carolina. Tank mix additional mode-of-actions such as AXIOM, FIERCE, ZIDUA, or PROWL H2O to your herbicide program for resistance management.* **Rainfast interval = 4 hours.**

<i>pendimethalin</i> Prowl H2O 3.8 CS		0.71-1.43 lb 1.5-3.0 pt	3	60 days	24 hours
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Comments: *Labeled for wheat only.* Apply PROWL H2O prior to weed emergence from the 1-leaf growth stage up to before the flag leaf is visible. Emerged weeds will not be controlled by PROWL H2O. Plant wheat seed at least 1/2-inch to 1-inch deep to avoid crop injury. Do not apply more than 3.0 pt of PROWL H2O per acre per season.

Postemergence Herbicides for Weed Management in Small Grains (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>pinoxaden</i>		0.054 lb	1	60 days	48 hours
Axial XL 0.42 SL	16.4 fl oz			(grain)	

Comments: *Labeled for wheat and barley only.* Apply from 2-leaf to the pre-boot stage. No other surfactants are required. See label for tank mix partners. Do not graze livestock or harvest forage for hay from treated wheat and barley for a minimum of 30 days following application. Wheat and barley straw may be fed to livestock 60 days after application. AXIAL may be mixed in a spray solution containing up to 50% liquid nitrogen fertilizer. ACCase-resistant (MOA=1) Italian ryegrass populations are present in South Carolina. Tank mix additional modes-of-action, such as AXIOM, FIERCE, ZIDUA, or PROWL H2O, to your herbicide program for resistance management **Rainfast interval = 30 minutes.**

<i>prosulfuron</i>		0.0178 lb	2	60 days	12 hours
Peak 57DG	0.5 oz			(grain)	

Comments: *Labeled for wheat, barley, triticale, rye, and oats.* Apply to crop after spike stage but before the 2nd node (Feekes scale 7) is detectable during elongation. For control of small (2-6 inches), actively growing winter weeds including wild radish, wild mustard, shepherdspurse, and wild garlic. Apply when wild garlic is less than 8 inches tall. Add NIS at 1 qt/100 gallons of spray solution. Do not make foliar or soil application of any organophosphate insecticide within 15 days before or 10 days after PEAK application. Do not irrigate with 4 hours of PEAK application. Do not apply PEAK to crops that under severe stress due to drought, cold weather, hail, wind damage, sand blasting, flooding, or nutrient deficiency. Do not graze or feed forage from treated areas to livestock until 30 days after application. Tank mix partners include BANVEL, BUCTRIL, MCPA, and 2,4-D. **Rainfast interval = 4 hours.**

<i>pyrasulfotole</i>		0.027-0.036 lb	27	60 days	24 hours
+		+		(grain/straw)	
<i>bromoxynil</i>		0.15-0.20 lb	6		
Huskie 2.06EC	11-15 fl oz				

Comments: *Labeled for wheat, barley, rye, and triticale.* HUSKIE is a RESTRICTED USE PESTICIDE. Apply HUSKIE in a minimum of 10 gallons of water per acre from the fully expanded first true leaf up to flag leaf emergence. See HUSKIE label for instructions on aerial applications. Add NIS at 1 qt per 100 gal of spray solution plus AMS at 1 lb/A. Do not use air induction or flood jet nozzles for ground applications of HUSKIE. Treat broadleaf weeds when they are small and actively growing. Do not apply more than 15 fl oz/A of HUSKIE per application. Do not make more than one application of HUSKIE per season. Do not apply HUSKIE in a tank mixture with a TEBUCONAZOLE fungicide. Tank mixing HUSKIE with fungicides may cause temporary yellowing, leaf burn, and/or height reduction of the crop. Do not graze or harvest forage within 25 days after application. **Rainfast interval = 1 hour.**

<i>pyroxsulam</i>		0.016 lb	2	60 days	12 hours
PowerFlex 7.5DF	3.5 oz			(grain)	
PowerFlex HL 13DF	2.0 oz				

Comments: *Labeled for wheat only.* For control of ACCase-resistant annual ryegrass and other annual grass and broadleaf weeds. Apply from 3-leaf to jointing stage. Apply with NIS at 1 to 2 qt/100 gal of spray solution or COC at 1.0-1.25 gal/ 100 gal of spray solution. Application of ammonium nitrogen fertilizer (topdress) 7 days before or after an application of POWERFLEX/HL can result in stunting and foliar crop burn; therefore, do not apply topdress during this time period. If applied in fluid fertilizer, reduce NIS rate to 1 qt/100 gal of spray solution. Do not apply an organophosphate insecticide within 5 days before or 5 days after an application of POWERFLEX/HL. Do not apply more 0.016 lb ai of PYROXSULAM per acre per growing season. Do not cut treated crop for hay within 28 days following application. Do not graze treated crop within 7 days of application. ALS-resistant (MOA=2) Italian ryegrass populations are present in South Carolina. Tank mix additional mode-of-actions such as AXIOM, FIERCE, ZIDUA, or PROWL H2O to your herbicide program for resistance management. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Small Grains (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>thifensulfuron</i>		0.014-0.027 lb	2	45 days	24 hours
+		+		(grain)	
<i>fluroxypyr</i>		0.07-0.14 lb	4		
Sentrallas 1.550D	7-14 fl oz				

Comments: *Labeled for wheat, barley, and oats.* The maximum use rate for oats is 9 fl oz/A. Apply SENTRALLAS from the 2-leaf growth stage up to just before flag leaf emergence. Add non-ionic surfactant at 0.5 to 2.0 pt per 100 gallon of spray solution plus an ammonium containing fertilizer, such as AMS at 2 qt/A or UAN at 2 lb/A. Target application when broadleaf weeds are actively growing and less than 4 inches tall or diameter. Warm and moist conditions will promote weed growth and enhance SENTRALLAS activity on broadleaf weeds; however, cold or drought stress may result in poor control and subsequent weed regrowth. Do not apply SENTRALLAS to wheat, oat, or barley that is stressed by drought, low fertility, water saturated soil, disease or insect damage, as crop injury may occur, particularly during the 2- to 5-leaf growth stage. Do not make more than one application of SENTRALLAS per year in oats. Tank mix partners include 2,4-D, MCPA, DICAMBA, EXPRESS, ALLY, WIDEMATCH, or STINGER. Do not use SENTRALLAS plus MALATHION insecticide because crop injury may occur. Do not graze or harvest treated forage within 7 days of application. Do not harvest treated hay within 30 days of application. **Rainfast interval = 1 hour.**

<i>thifensulfuron</i>		0.0094-0.0188 lb	2	45 days	12 hours
+		+		(grain)	
<i>tribenuron</i>		0.0047-0.0094 lb	2		
Harmony Extra 50SG	0.45-0.9 oz				
Nimble 75 WDG	0.3-0.6 oz				

Comments: *Labeled for wheat, barley, and oats.* The maximum is rate for HARMONY EXTRA SG in oats is 0.6 oz/A (0.4 oz/A NIMBLE/HARMONY EXTRA XP). For control of small (2-4 inches), actively growing broadleaf weeds including wild radish and henbit. Apply when wild garlic is less than 12 inches tall. Apply to crop after the 2-leaf stage but before flag leaf is visible. Add NIS at 1 qt/100 gallons of spray solution. For wild radish control in barley and wheat, use 0.6-0.9 oz/A rate of HARMONY EXTRA 50 SG with TotalSol (0.5-0.6 oz of HARMONY EXTRA XP 75 DF or NIMBLE 75 WDG). Do not tank mix with MALATHION insecticide or severe crop injury will occur. If liquid nitrogen is the carrier, reduce surfactant rate to 0.5-1.0 pt per 100 gal of solution (to reduce potential foliar burn). For improved control of wild radish, tank mix HARMONY EXTRA with 2,4-D or MCPA. Do not use surfactant if applying with 2,4-D or MCPA in a nitrogen fertilizer carrier. Do not harvest treated crop for forage within 7 days or hay within 30 days of HARMONY EXTRA application. **Rainfast interval = several hours of dry weather.**

<i>tribenuron</i>		0.012-0.023 lb	2	45 days	12 hours
Express 75 WDG	0.25-0.5 oz			(grain/straw)	

Comments: *Labeled for wheat and barley only.* Apply EXPRESS from the 2-leaf stage up to flag leaf emergence. Add 0.5 to 4 pt of NIS per 100 gal of spray solution plus 2 qt/A of UAN or 2 lb/A of AMS. EXPRESS alone provides partial control of wild garlic, henbit, and wild radish. Tank mix with 0.25 to 0.375 lb a.i. of MCPA for improved control of wild radish (less than 6" diameter rosette) Do not apply EXPRESS within 60 days of an in-furrow organophosphate insecticide application. **Rainfast interval = 2-3 hours.**

2,4-D amine (various)	0.5-1.0 pt	0.25-0.5 lb	4	14 days	12 hours
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Comments: *Labeled for wheat, barley, oats, and rye.* Oats are less tolerant of 2,4-D than barley, wheat, or rye. For fall seeded oats, use the lower rate to avoid injury. For control of weeds such as vetch, wild mustard and radish, apply after crop is fully tillered but before jointing. Do not apply under conditions which favor drift onto nearby, sensitive crops. **Rainfast interval = N/A (suggest 1 hour).**

Harvest Aids for Small Grains

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>flumioxazin</i>		0.048-0.064 lb	14	10 days	12 hours
Valor SX 51WDG	1.5-2.0 oz				
Valor EZ 4SC	1.5-2.0 fl oz				

Comments: *Labeled for wheat only.* Apply VALOR SX after wheat reaches the hard dough stage and grain moisture is less than 30%. GLYPHOSATE is the recommended tank mix partner to control existing weeds and aid in harvest. Apply in a minimum of 10 gallons spray solution per acre by ground application and a minimum of 5 gallons per acre by aerial application. For proper desiccation, add a methylated seed oil which contains at least 15% emulsifiers and 80% oil at 1 qt/A plus a spray grade nitrogen source (either ammonium sulfate at 2-2.5 lb/A or 28-32% nitrogen solution at 1-2 qt/A). **Rainfast interval = N/A (suggest 1 hour).**

<i>glyphosate</i> (various)	22 fl oz	0.75 lb ae	9	7 days	12 hours
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Comments: *Labeled for wheat and barley.* Apply GLYPHOSATE after hard dough stage of grain (30% or less grain moisture) at least 7 days before harvest. Do not apply to wheat or barley grown for seed. Do not apply more than 0.75 lb ae/A for a preharvest application. **Rainfast interval = N/A (suggest 1 hour).**

<i>saflufenacil</i>		0.022-0.045 lb	14	3 days	12 hours
Sharpen 2.85 SC	1.0-2.0 fl oz				

Comments: *Labeled for use in wheat, barley, and triticale.* Apply SHARPEN after crop has reached physiological maturity (hard dough stage and grain moisture is less than 30%). Thorough spray coverage is essential for optimum desiccation and weed control. Apply in a minimum spray volume of 10 gallons per acre by ground and 5 gallons per acre by air. Add methylated seed oil (MSO) at 1 gal per 100 gal plus ammonium sulfate (AMS) at 8.5 to 17 lbs per 100 gals or urea ammonium nitrate (UAN) at 1.25 to 2.5 gals per 100 gals of spray volume. Do not apply more than 2.0 fl oz/A of SHARPEN per cropping season for desiccation uses. SHARPEN may be tank mixed with GLYPHOSATE for additional preharvest weed desiccation (increases PHI to 7 days). Do not apply SHARPEN to barley, wheat, or triticale grown for seed production. SHARPEN treated barley, wheat, and triticale straw may be grazed or fed to livestock.

<i>2,4-D amine</i> (various)	1.0 pt	0.5 lb	4	14 days	12 hours
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Comments: *Labeled for wheat, barley, oats, and rye.* Apply 2,4-D when grain is in the hard dough stage or later to control weeds that may interfere with harvest or to suppress perennial weeds at least 14 days before harvest. Do not apply from early boot to milk stage of growth development. Do not apply more than 1.0 pt/A per application or under conditions which favor drift onto nearby, sensitive crops. **Rainfast interval = N/A (suggest 1 hour).**

SMALL GRAIN INSECT CONTROL

Pest	Product	Rate /acre	Comments
Aphids	<u>Seed Treatments</u>		Preventative aphid treatment for barley yellow dwarf virus suppression is recommended for high yield wheat and oat production under SC conditions. Either seed treatment or foliar pyrethroid application are both effective.
	Enhance AW	4.0 oz / 100 lb	
	Gaicho 600, Axxcess, Attendant 600	0.8 fl oz / 100 lb	Seed treatments provide early season control of aphids and barley yellow dwarf. Seed treatments also suppress Hessian fly but will not control heavy HF infestations. For Hessian fly suppression, Enhance AW 4 oz / 100 lb, 1.6 fl oz / 100lb Gaicho 600, or 1.33 fl oz / 100lb Cruiser is recommended.
	Gaicho XT	3.4 fl oz / 100 lb	
	Cruiser 5FS	1.0 fl oz / 100 lb	A foliar pyrethroid application in topdress N by mid-February (early Feb. for best results) is also highly effective in suppressing aphid virus transmission.
	NipsIt Inside	0.75-1.79 fl oz / 100 lb	
	<u>Foliar</u>		Aphid treatments are most likely to be profitable on early-planted high-yield-potential wheat (60+ bu/ac). The key pest is the oat-bird cherry aphid which is the major vector or carrier of barley yellow dwarf virus. This aphid typically has a dark green body with reddish area on the "rear end".
	Karate Z, others	1.3 – 1.9 oz (1 gal / 100-66 ac)	
	Warrior, Silencer, others, 1EC	2.6 – 3.8 oz (1gal /50-33 ac)	If preventative treatment was not previously applied, aphid treatment is recommended if you find 8 oat-bird cherry aphids per row foot prior to jointing.
	Baythroid XL 1EC	1.0 – 1.5 fl oz (1 gal / 128-85 ac)	
Declare, Prolex	2.6 – 3.8 fl oz (1 gal / 49-33 ac)	Oats are more susceptible to barley yellow dwarf than wheat. Enhance AW hopper box seed treatment is recommended to control aphids and smut on oats. If a foliar pyrethroid is used to control aphids on oats, treatment should be earlier (Dec. – Jan.) than on wheat.	
Proaxis 0.5	7 – 10.5 fl oz		
Sivanto	0.75 fl oz	Karate, Warrior, Silencer have been particularly effective in suppressing barley yellow dwarf virus on oats and wheat and giving season-long protection against later head infestation by English grain aphids on wheat.	
Transform	7 – 10.5 fl oz		
		0.75 fl oz	English grain aphids (light green bodies with long black "exhaust pipes" protruding upward from rear end) increase during jointing and move to heads as they emerge in April.
			The treatment guideline for English grain aphid is 2-3/stem during jointing; 5/stem at head emergence to blooming; 10/stem at milk; dough stage is too late to spray. Wheat treated earlier for virus prevention should not have significant aphid infestation of the heads.

Pest	Product	Rate /acre	Comments
Cereal Leaf Beetle	Baythroid XL	1.0 – 1.8 fl oz	Cereal leaf beetles first hatch out in March and peak feeding occurs in April. Treat if you have 1 larva on every other stem (average of 0.5 larvae / stem).
	Karate Z, others	1.3 – 1.9 oz	
	Warrior, Silencer, others, 1EC	2.6 – 3.8 oz	Karate, Warrior, Silencer also provide season-long aphid control.
	Mustang MAX Respect 0.8 EC	2.6 – 3.2 oz	
	Declare, Prolex Proaxis 0.5	1.0 – 1.5 fl oz	
	Tombstone 2.0	2.6 – 3.8 fl oz	Do not make more than 2 applications of Blackhawk per season. If additional treatments are required, rotate to another effective class of insecticides.
	Blackhawk	2.4 oz	
True Armyworm	Baythroid XL 1 EC	1.8 – 2.4 fl oz	Treat when armyworm populations reach 2 per drill ft. True armyworm infestations usually occur after flag leaf emergence.
	Karate Z, others Warrior, Silencer, others, 1EC	1.9 oz 3.8 oz	
	Lannate LV Lannate 90 SP	1.5 pt 0.5 lb	
	Mustang MAX Respect 0.8 EC	3.2 oz	
	Declare, Prolex Proaxis 0.5	1.5 fl oz 3.8 fl	
	Radiant 1 SC	3 – 6 oz	Do not make more than 2 applications of Blackhawk per season. If additional treatments are required, rotate to another effective class of insecticides.
	Tombstone 2.0	2.4 oz	
	Blackhawk	1.1 – 3.3 oz	

Pest	Product	Rate /acre	Comments
Fall Armyworm	Sevin 80S	1.75 lb	Treat if the stand is threatened before frost. Fall armyworm infestations may occur on early planted seedling stage small grain. Do not make more than 2 applications of Blackhawk per season. If additional treatments are required, rotate to another effective class of insecticides.
	Sevin XLR	1.5 qt	
	Sevin 4F	1.5 qt	
	Karate Z, others	1.9 oz	
	Warrior, Silencer, others, 1EC	3.8 oz	
	Lannate LV	1.5 pt	
	Lannate 90 SP	0.5 lb	
	Mustang MAX	3.2 oz	
Respect 0.8 EC			
Declare, Prolex	1.5 fl oz		
Proaxis 0.5	3.8 fl oz		
Radiant 1 SC	3 – 6 oz		
Tombstone 2.0	2.4 oz		
Blackhawk	1.7 – 3.3 oz		
Grasshoppers	Baythroid XL	2.4 fl oz	Grasshoppers typically attack wheat after flag leaf emergence. There are no well-established thresholds for grasshopper treatment. Prevent flag leaf defoliation.
	Karate Z, others	1.9 oz	
	Warrior, Silencer, others, 1EC	3.8 oz	
	Malathion 8 EC	1.25 pt	
	Malathion 57 EC	2.0 pt	
	Methyl Parathion 4 EC	1 pt	
	Pennacap-M	2-3 pt	
Mustang MAX, Respect 0.8 EC	3.2 – 4.0 oz		
Declare, Prolex	1.5 fl oz		
Proaxis 0.5	3.8 fl oz		
Tombstone 2.0	2.4 oz		
Spider Mites / Winter Grain Mite	Methyl Parathion 4 EC	1 – 1.5 pt	Treat when mites are present and causing leaf discoloration. Late season (dough stage) populations are unlikely to cause economic injury.
	Pennacap-M	2 -3 pt	

Pest	Product	Rate /acre	Comments
Hessian Fly	Varietal resistance is the most economical way to manage Hessian fly. HF resistance declines over time and varies by location depending on the predominant races of Hessian fly present. Treat susceptible varieties on farms with a history of economic damage. Proximity to wheat stubble from previous crop increases HF risk. When possible, try to rotate wheat blocks at least 1/3 - 1/2 mile away from previous year's stubble. Wheat planted in the coastal plain before 15 Nov is most susceptible to HF. Wheat, barley, and triticale are susceptible to HF. Rye has low susceptibility to Hessian fly and oats are immune to any injury.		
	<u>Seed Treatment</u>		
	Enhance AW	4 oz / 100 lb	Barley is tolerant. Damage only occurs under severe infestations. Rye is highly resistant, and oats are immune to Hessian fly.
	Gaucho 600, Axxess Attendant 600 Cruiser 5FS	2.4 fl oz/100 lb	Seed treatments will suppress but not control Hessian fly. Seed treatments also provide early season control of aphids and barley yellow dwarf. Enhance AW and Gaucho XT also control smut and certain seedling diseases.
	Gaucho XT + Gaucho 600	3.4 fl oz + 1.0 fl oz / 100 lb	Gaucho XT only has one-half the insecticide active ingredient of the 1.6 oz rate of Gaucho 600. Adding 0.8 oz Gaucho 600 to Gaucho XT gives the same level of a.i. as 1.6 oz Gaucho 600.
	Cruiser 5FS	1.33 fl oz / 100 lb	
	<u>Foliar</u>		
Karate Z, others Warrior, Silencer, others, 1EC	1.9 oz 3.8 oz	Foliar treatment at early post emergence (2-4 leaf stage) may reduce fall infestation on susceptible varieties. March treatment (jointing) timed to spring HF egg laying is recommended if 10% of stems are infested by February.	
Declare, Proaxis	1.54 oz 3.84 oz		
Insecticide seed treatment note: The amount of insecticide active ingredient actually applied to 100 lb of seed for labeled rates of imidicloprid formulations is as follows: Enhance AW 4 oz (0.05 lb ai); Gaucho XT 3.4 fl oz (0.03 lb ai) + Gaucho 600 1.6 fl oz (0.06 lb ai) = 0.094 ai; Gaucho 600 2.4 fl oz (0.094 ai).			

Small Grain Insecticide Use Precautions

Active Ingredient	Brand Name	Pre-Harvest (Days)	Pre-Grazing (Days)	Small Grains Labeled
beta-cyfluthrin	Baythroid XL 1 EC	30	7	wheat
carbaryl	Sevin	21	7	wheat, triticales
cyfluthrin	Tombstone 2.0	30	7	wheat, triticales
flupyradifurone	Sivanto 200 SL	21	no grazing restriction	wheat, oats, barley, rye, triticales
imidacloprid	Enhance AW, Gaucho	45	45	wheat, oats, barley
lambda-cyhalothrin	Karate Z 2.08 Warrior	30	7	wheat, oats, barley, rye, triticales
gamma cyhalothrin	Declare, Proaxis 0.5	30	7	wheat, triticales
malathion	Malathion	7	7	wheat, oats, barley, rye, triticales
methomyl	Lannate	7	10	wheat, oats, barley, rye, triticales
methyl parathion	Methyl 4EC PennCap-M	15	15	wheat, oats, barley, rye, triticales
spinetoram	Radiant 1 SC	21	3	wheat, oats, barley, rye, triticales
spinosad	Tracer	21	14	wheat, oats, barley, rye, triticales
	Blackhawk	21	once material dries	
sulfoxaflor	Transform 50WG	14	7	wheat, barley, triticales
thiamethoxam	Cruiser 5FS	seed treat.	no grazing restriction	wheat, barley, triticales
zeta-cypermethrin	Mustang MAX	14	14	wheat, triticales
	Respect 0.8 EC			

SMALL GRAIN DISEASE CONTROL

Diseases	Product	Rate fl oz/Ac	<p style="text-align: center;">Comments</p> <p>Note: Fungicide seed treatments provide relatively cheap stand insurance and smut protection.</p>
<p>Smuts and Seedling Blights</p>	Charter 0.21 FS	3.1 fl oz	Farm or commercial seed treaters. See label for details
	CruiserMaxx Vibrance Cereals	5 oz	Multiple seed and seedling diseases. Also labeled for oats and triticale.
	Dividend Extreme	2-4 fl oz	Also labeled for triticale.
	Gaucho	3.4 fl oz	See label.
	Maxim 4 FS	0.08-.016 fl oz	See label.
	Rancona V RTU FS	4.6 fl oz	Do not graze or feed livestock on treated areas for 6 weeks.
	Raxil MD 11.6 S	5-6.5 fl oz	On-farm or commercial seed treaters. Do not graze for 38 days.
	Vibrance Extreme	2.8- 5.6 fl oz	Also labeled for oats and triticale. See label.
<p>Powdery Mildew, Leaf Rust, Leaf /Glume Blotch, Tan Spot, Stripe Rust</p>	Single MOA		<p>The most effective preventative fungicide timing for wheat yield response is usually just after the flag leaf has fully emerged (boot stage). This flag leaf application usually controls the two greatest yield threats – leaf rust and glume blotch. If head scab is a concern, a slightly later timing (see comments below) still provides some rust and glume blotch protection. Wheat with 60 bu/ac yield potential is most likely to respond to fungicide treatment.</p> <p>Treat powdery mildew if 20 % of leaf area is infected on leaf below flag leaf, and cool (high < 75 F), wet weather predicted.</p> <p>NOTE: Early treatments for powdery mildew during tillering do not provide adequate residual control of rust infections.</p> <p>Leaf Rust susceptible varieties should be treated preventatively at fully emerged flag leaf, or at the first sign of rust if earlier.</p> <p>Treat for leaf/glume blotch or tan spot if 25 % of stems have a lesion on leaf below flag leaf.</p> <p>Thus far, economic injury from stripe rust has been rare in SC. Stripe rust is a very aggressive disease which responds best to preventative treatment of the emerged flag leaf. Standard preventative treatment at flag leaf emergence should prevent damage under S. C. conditions. If a rescue treatment is needed for stripe rust (not common leaf rust) use Tilt.</p>
	Aftershock 480 SC	3-5.5 fl oz	
	Alto 100	3-5.5 fl oz	
	Bumper, Proprimax (generic Tilt)	4 fl oz	
	Caramba	10-14 fl oz	
	Tebuconazole (generic Folicur)	4 fl oz	
	Headline 2.09 SC	4-8 fl oz	
	Quadris 2.08 F	6 fl oz	
	Multiple MOA		
	Absolute 500 SC	5 fl oz	
	Aproach Prima	3.4-6.8 fl oz	
	Fortix	4 – 6 fl oz	
	Priaxor 4.17 SC	4 – 8 fl oz	
	Prosaro	6.5 fl oz	
	QuiltXcel	7 - 14 fl oz	
	Stratego YLD	4 fl oz	
Trivapro 1.75 EC	9.4-13.7 fl oz		
Twinline 3.72 SC	9 fl oz		

Diseases	Product	Rate fl oz/Ac	Comments
Head Scab	Caramba	14 - 17 oz	Applications for head scab should be made when 50% of the heads are fully emerged. Scab suppression requires excellent coverage of the heads. See label for nozzle and spray volume recommendations. Harvest Restriction is 30 days.
	Tebuconazole	4 oz	
	Proline	5.0 - 5.7 oz	
	Prosaro	6.5 - 8.5 oz	

Disease Response to Small Grain Fungicides

	Rate (fl oz)	Powdery Mildew	Leaf and Glume Blotch	Tan Spot	Stripe Rust	Leaf Rust	Head Scab
Approach Prima	3.4 - 6.8	G - E	G	G	E	G - E	P
Caramba	10 - 17	G	G	F	G - E	E	G
Tebuconazole (generic Folicur)	4	F	G	G	G - E	E	F
Headline	6 - 9	F	G-E	E	G - E	E	P
Proline	4.3 - 5.7	G	G	G	G - E	E	G
Prosaro	6.5 - 8.5	G	G	G	G - E	E	G
Priaxor	4 - 8	G	G	G	G - E	E	F
Quadris	6.2 - 10.8	F	G	E	G - E	E	P
Fortix	4 - 6	--	--	G - E	E	G - E	P
QuiltXcel	7 - 14	G-E	G	E	E	E	P
Stratego YLD	4	E	G	E	G	G	P
Tilt	4	E	G	G	G	G	P
Trivapro	9.4 - 13.7	G - E	G - E	G - E	E	E	P
Twinline	7 - 9	G - E	G	E	E	E	F

E=excellent, G=good, F=fair, P=poor, --=insufficient data

Small Grain Fungicide Use Precautions

Active Ingredient	Brand Name	Application Restriction	Small Grains Labeled
Foliar Fungicides			
azoxystrobin	Quadris	up to flowering	wheat, barley
metconazole	Caramba	30 day preharvest	wheat, barley, oats, rye triticale
metconazole + pyraclostrobin	Twinline, Multiva	30 day preharvest	wheat, barley, oats, rye triticale
picoxystrobin	Aproach	up to flowering	wheat, barley, oats, rye triticale
picoxystrobin + cyproconazole	Aproach Prima	45 day preharvest	wheat, triticale
propiconazole	Tilt, PropiMax, Bumper	up to flowering	wheat, barley, rye, oats
propiconazole + azoxystrobin	Quilt, QuiltXcel	up to flowering	wheat, barley, triticale
prothioconazole + trifloxystrobin	Stratego, Stratego YLD	up to fully emerged flag leaf	wheat, barley
prothioconazole	Proline	30 day preharvest	wheat, barley, oats, rye, triticale
prothioconazole + tebuconazole	Prosaro	30 day preharvest	wheat, barley, oats
pyraclostrobin	Headline	up to flowering	wheat, rye, barley
tebuconazole	Orius, Monsoon, Tebuzol, etc.	30 day preharvest	wheat, barley
Seed Treatments			
carboxin + captan	Enhance AW	seed treatment	wheat, barley, oats
carboxin-thiram	Vitavax 200, RTU Vitavax-Thiram	seed treatment	wheat, oats, barley, rye
difenoconazole + metalaxyl	Dividend XL, Dividend Extreme	seed treatment	wheat, barley
fludioxonil	Maxim 4FS	seed treatment	wheat, oats, barley, rye, triticale
mefenoxan	Apron XL, Apron XL-LS	seed treatment	wheat, oats, barley, rye, triticale
sedaxane + difenoconazole + mefenoxam	Vibrance Extreme	seed treatment	wheat, oats, barley, rye, triticale
tebuconazole	Raxil	seed treatment	wheat, oats, barley
imidacloprid	Gaucha	seed treatment	wheat, oats, barley, rye

SOYBEAN WEED CONTROL

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i> Aim 2EC	1.0-2.0 oz	0.016-0.032 lb	14	3 days	12 hours
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Comments: Apply any time before planting. For best results, apply when weeds are less than 4 inches tall (less than 3 inch rosettes). Use higher rate for treating larger weeds. Add a COC (1-2 gal per 100 gals spray solution, NIS (1 qt per 100 gals spray solution), or MSO (1-2 gal per 100 gals of spray solution). Add 2,4-D to improve control of cutleaf eveningprimrose and wild radish. Tank mix partners include GLYPHOSATE, LIBERTY, GRAMOXONE, 2,4-D LVE, or CLARITY. **Rainfast interval = 6-8 hours.**

<i>chloransulam-methyl</i> FirstRate 84WDG	0.3-0.8 oz	0.016-0.042 lb	2	65 days	12 hours
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Comments: Apply FIRSTRATE up to 14 days before planting soybean. Provides control of marestalk up to 6 inches in height. For improved control of emerged weeds at the time of application, tank mix FIRSTRATE with 2,4-D LVE, GRAMOXONE, or GLYPHOSATE. **Rainfast interval = 2 hours.**

<i>chlorimuron</i> +		0.014-0.023 lb	2	---	12 hours
<i>flumioxazin</i> +		0.046-0.073 lb	14		
<i>thifensulfuron</i> Envive 41.3DF	2.5-4.0 oz	0.005-0.007 lb	2		

Comments: Apply ENVIVE 7 to 14 days before soybean planting. To ensure proper coverage of target weeds (1-3" tall), use 10 to 30 gallons of spray solution per acre. ENVIVE may be tank mixed with 2,4-D LVE, GLYPHOSATE, CLARITY, or GRAMOXONE. If tank mixing with 2,4-D, observe the more restrictive waiting interval for (14-30 days, depending on rate). **Rainfast interval = 1 hour.**

<i>chlorimuron-ethyl</i> +		0.005-0.010 lb	2	60 days	12 hours
<i>thifensulfuron</i> Synchrony XP 28.4DG	0.375-0.75 oz/A	0.002-0.003 lb	2		

Comments: Apply SYNCHRONY XP up to 30 days before planting soybeans. Add crop oil concentrate at 1 gal per 100 gal of spray solution plus ammonium sulfate at 2 lb/A or urea ammonium nitrate at 2 qt/A. If weeds greater than 3 inches in height are present, tank mix with one or more of the following depending on weed spectrum, GLYPHOSATE, 2,4-D LVE, DICAMBA, PARAQUAT, GLUFOSINATE, SHARPEN, or VALOR. Provides limited residual control of sicklepod, common cocklebur, annual morningglory, and marestalk. Do not apply more than 0.051 lb ai of chlorimuron ethyl per acre per year. Do not apply more 0.047 lb ai of thifensulfuron per acre per year. **Rainfast interval = 1 hour.**

<i>dicamba</i> Clarity/Banvel 4S	4.0-16 oz	0.13-0.5 lb	4	---	24 hours
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Comments: Apply CLARITY or BANVEL to control emerged broadleaf weed before soybean planting. Following an application of CLARITY or BANVEL and a minimum accumulation of 1" rainfall or overhead irrigation, a waiting interval of 14 days is required for 8 oz/A or less and 28 days for 16 oz/A. These intervals must be observed before planting soybeans or crop injury may occur. **Rainfast interval = 4 hours.**

Preplant/Burndown Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>flumetsulam</i>		0.04-0.05 lb	2	85 days	12 hours
Python 80WDG	0.8-1.0 oz				

Comments: Apply PYTHON up to 30 days before planting soybeans. If weeds are present at time of application, tank mix with 2,4-D, GLYPHOSATE, PARAQUAT, or LIBERTY. Use the lower rate of PYTHON on soils that have a sand or loamy sand texture throughout the profile. Do not use in areas where the soil pH is greater than 7.8 as this may result in unacceptable crop injury.

<i>flumioxazin</i>		0.064-0.096 lb	14	60 days	12 hours
Valor SX 51WDG	2.0-3.0 oz				
Valor EZ 4SC	2.0-3.0 fl oz				

Comments: Apply VALOR a minimum of 15 gallons of water at least 14 days before planting soybeans. Add MSO or COC at 1-2 pt per 100 gal of spray mixture or NIS at 0.25% v/v (1 qt per 100 gal of spray mixture). If weeds are present, tank mix with GLYPHOSATE, 2,4-D LVE, or GRAMOXONE. For additional residual grass and broadleaf control, tank mix with PROWL, COMMAND, SCEPTER, METRIBUZIN, PYTHON, LOROX, and/or SQUADRON. Areas (i.e., in the crop rows) that are excessively disturbed during the planting operation may see diminished weed control. *Be sure to follow the clean-out instructions for removing VALOR from the sprayer after each day's use; do not let VALOR sit overnight in the tank. Rainfast interval = 1 hour.*

<i>flumioxazin</i>		0.080-0.096 lb	14	---	12 hours
Gangster V 51WDG	2.5-3.0 oz				
+	+	+			
<i>chloransulam</i>		0.026-0.032 lb	2		
Gangster FR 84DF	0.5-0.6 oz				

Comments: GANGSTER is a co-pack of GANGSTER V and GANGSTER FR. Apply a minimum of 14 days before planting soybeans. If weeds are present, tank mix with GLYPHOSATE, GRAMOXONE, or 2,4-D. Do not tank mix VALOR in soybean fields with products containing flufenacet (AXIOM), metolachlor (DUAL), or dimethenamid-p (OUTLOOK) as severe crop injury may occur if prolonged, cool wet conditions follow application. For additional residual grass and broadleaf control, tank mix with PROWL, COMMAND, SCEPTER, METRIBUZIN, PYTHON, LOROX, and/or SQUADRON. *Be sure to follow the clean-out instructions for removing GANGSTER from the sprayer after each day's use; do not let GANGSTER sit overnight in the tank.*

<i>flumioxazin</i>		0.057-0.094 lb	14	---	12 hours
+		+			
<i>chlorimuron</i>		0.019-0.032 lb	2		
Valor XLT 40.3WDG	3.0-5.0 oz				

Comments: Apply VALOR XLT a minimum of 14 days prior to planting soybeans. For enhanced residual control of weeds in reduced tillage fields, tank mix with BOUNDARY, DOMAIN, ALACHLOR, S-METOLACHLOR, DIMETHENAMID, or FLUFENACET. Areas (i.e., in the crop rows) that are excessively disturbed by the planting operation may see diminished weed control. Do not apply VALOR XLT within 14 days before or after an application of an organophosphate insecticide on any soybean variety that is not STS or STS/RR. *Be sure to follow the clean-out instructions for removing VALOR XLT from the sprayer after each day's use; do not let VALOR XLT sit overnight in the tank.*

Preplant/Burndown Herbicides for Weed Management in Soybean (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>flumioxazin</i> +		0.063-0.079 lb	14	None	12 hours
<i>pyroxasulfone</i> Fierce 76DF Fierce EZ 2.04SC	3.0-3.75 oz 6.0-9.0 fl oz	0.080-0.100 lb	15		

Comments: Apply FIERCE/EZ anytime before soybean planting. Do not apply more than 3.75 oz/A of FIERCE/EZ during a single growing season. Add a COC at 1 pt/A or NIS at 0.5% v/v (2 qt per 100 gal of spray solution) plus AMS at 17 lbs per 100 gal of water. Apply in a minimum of 15 gallons of water per acre. Tank mix partners include 2,4-D LVE, COMMAND, EXTREME, METRIBUZIN, FIRSTRATE, GLYPHOSATE, LIBERTY, LOROX, PARAQUAT, PURSUIT PLUS, PENDIMETHALIN, PYTHON, SCEPTER, SELECT MAX, VALOR, and VALOR XLT. Spray equipment, including mixing vessels and nurse tanks, must be cleaned each day following FIERCE/EZ application. Soybean injury may occur if FIERCE/EZ herbicide is applied preplant in the same field as a planned preemergence application of flufenacet (AXIOM, DOMAIN), alachlor (Micro-Tech), metolachlor (DUAL, BOUNDARY), or dimethenamid (OUTLOOK).

<i>fomesafen</i> +		0.25-0.37 lb	14	45 days	24 hours
<i>glyphosate</i> Flexstar GT 3.29SL	3.0-4.5 pt	1.0-1.6 lb	9		

Comments: Apply FLEXSTAR GT 7 to 14 days before soybean planting. FLEXSTAR GT is formulated with built-in adjuvant system which minimizes the need for additional spray adjuvants. Add AMS at 8.5-17 lb per 100 gallons of water. Under conditions where target weeds are under stress including moisture or temperature, add COC or MSO at 2-4 qt per 100 gallons of water or NIS at 1-2 qt per 100 gallons of water. Use of drift control agents is not recommended. Do not exceed 4.5 pt of FLEXSTAR GT per acre per season. **Rainfast interval = 2 hours.**

<i>glufosinate</i> Liberty 280 2.34SL Interline 2.34SL	32-43 fl oz	0.59-0.79 lb	10	70 days	12 hours
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Comments: Thorough spray coverage is essential for optimum performance. Ground application requires a minimum of 15 gallons of water per acre. Dense weed canopies require 20 to 40 gallons per acre. Best results obtained when daytime temps exceed 75 F. Consult label for more details. **Rainfast interval = 4 hours.**

<i>glyphosate</i> (various)	22-32 oz	0.75-1.13 lb ae	9	7 days	4 hours
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Comments: Apply in 10-20 gal of water 2 to 4 weeks prior to your anticipated planting date to control existing groundcover. In most fields, a follow-up application of PARAQUAT will be needed at planting. Consult product label to determine if a NIS is needed. **Rainfast interval = 2 hours.**

<i>oxyfluorfen</i> Goal 2XL	1.0-2.0 pt	0.25-0.5 lb	14	7 days	24 hours
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Comments: Apply GOAL 2XL a minimum of 7 days before planting soybeans. Tank mix with GLYPHOSATE or PARAQUAT for control of larger winter annual broadleaf weeds or annual grasses in fallow beds (fall or late winter/early spring burndown). Provides postemergence and soil residual control of horseweed, pigweeds, and henbit.

Preplant/Burndown Herbicides for Weed Management in Soybean (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>saflufenacil</i> Sharpen 2.85SC	1.0 fl oz	0.022 lb	14	80 days	12 hours
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Comments: Apply SHARPEN a minimum of 30 days before planting soybeans for coarse soils with less than 2.0% organic matter. Preplant interval for soils with greater than 2% organic matter is 14 days (1.5 oz/A SHARPEN rate) and 30 days (2.0 oz/A SHARPEN use rate). Add MSO at 1 gal per 100 gal of spray solution plus nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). SHARPEN may be tank mixed with GLYPHOSATE, CLARITY, PROWL, PURSUIT, or SCEPTER. SHARPEN may be tank mixed with other MOA=14 products (i.e., VALOR or AUTHORITY) if a minimum of 14 days passes between application and planting. Group 14 herbicides labeled for postemergence application in soybean may be used 14 days after emergence. Do not apply more than 0.089 lb ai/A saflufenacil from all product sources per cropping season. Do not apply SHARPEN within 30 days of planting where an at-planting application of an organophosphate or carbamate insecticide is planned or has occurred, or severe crop injury may occur. Soybean forage may be fed or grazed 65 days or more after application. **Rainfast interval = 1 hour.**

<i>saflufenacil</i> +		0.022 lb +	14	80 days	12 hours
<i>dimethenamid-p</i> Verdict 5.57EC	5.0 fl oz	0.195 lb	15		

Comments: Apply VERDICT a minimum of 30 days before planting soybeans for coarse (sand, loamy sand, and sandy loam) soils with less than 2.0% organic matter. No preplant interval is required for coarse soils with greater than 2.0% organic matter and all medium/fine soils. Add MSO at 1 gal per 100 gal of spray solution plus nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). VERDICT may be tank mixed with GLYPHOSATE or CLARITY. If tank mixing with glyphosate, AMS is recommended. Do not apply VERDICT with other Group 14 products (i.e., AIM, VALOR, VALOR XLT, ET, PREFIX, or AUTHORITY) due to crop injury potential. Group 14 herbicides labeled for postemergence application in soybean may be used 14 days after emergence. Do not apply more than 0.089 lb ai of *saflufenacil* per acre from all product sources per cropping season. Do not graze or feed treated soybean forage, hay, or straw to livestock. **Rainfast interval = 1 hour.**

<i>saflufenacil</i> +		0.017-0.022 lb +	14	85 days	12 hours
<i>imazethapyr</i> +		0.047-0.062 lb +	2		
<i>pyroxasulfone</i> Zidua PRO 4.09SC	4.5-6.0 fl oz	0.08-0.107 lb	15		

Comments: Apply ZIDUA PRO a minimum of 30 days before planting soybeans for coarse (sand, loamy sand, and sandy loam) soils with less than 2.0% organic matter. No preplant interval is required for coarse soils with greater than 2.0% organic matter and all medium/fine soils. Add MSO at 1 gal per 100 gal of spray solution plus nitrogen fertilizer (UAN at 1.25-2.5 gals per 100 gal or AMS at 8.5-17 lbs/100 gals). OPTILL may be tank mixed with CLARITY, PROWL, OUTLOOK, SHARPEN, ZIDUA, and GLYPHOSATE. Do not apply ZIDUA PRO with other Group 14 products, such as flumioxazin or sulfentrazone, as a tank mix or sequential application within 30 days of planting because crop injury may result. Group 14 herbicides labeled for postemergence application in soybean may be used 14 days after emergence. Do not apply more than 6.0 oz/A of ZIDUA PRO in a single application or cumulatively per cropping season. Do not apply more than 0.089 lb ai/A of saflufenacil per cropping season in soybean from all product sources. Do not apply more than 0.112 lb ai/A of pyroxasulfone on coarse soils per cropping season in soybean from all product sources. Do not graze or feed treated soybean forage, hay, or straw to livestock. **Rainfast interval = 1 hour.**

2,4-D amine (various)	1.0-2.0 pt	0.475-0.95 lb	4	---	48 hours
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Comments: Apply 15 (1.0 pt/A) to 30 days (2.0 pt/A) prior to planting soybeans. Use the higher rate on larger weeds. Do not use on a light, sandy soil, or where soil moisture is limiting. Very effective on cutleaf eveningprimrose, wild mustard, and Palmer amaranth (<4"). Do not exceed 2.0 pt/A (1.0 lb ae/A) per season. Do not use an ester formulation if sensitive crops, particularly cotton, tobacco, or vegetables, are within a mile of the application site.

Preplant/Burndown Herbicides for Weed Management in Soybean (cont.)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>tiafenacil</i> Reviton 2.83SC	1.0-3.0 fl oz	0.022-0.066 lb	14	80 days	12 hours

Comments: Apply REVITON a minimum of 7 days before planting soybeans. The MSO adjuvant at 1 gal per 100 gal of spray solution is recommended. For COC, add 2 pts per 100 gal of spray solution. NIS is not recommended as reduced performance can occur. A nitrogen fertilizer (UAN at 2.5 gallons per 100 gal or AMS at 8.5 lbs/100 gals) may be added to the tank mix. Glyphosate may be tank mixed with REVITON for improved postemergence activity. Do not apply more than 6.0 oz/A of ZIDUA PRO in a single application or cumulatively per cropping season. Do not apply more than 0.223 lb ai/A of *tiafenacil* per year. A 25 foot buffer for ground applications and 150 foot buffer for aerial applications is required between point of direct application and closest downwind edge of sensitive terrestrial habitats. **Rainfast interval = 1 hour.**

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Soybean¹

	Aim/ET ²	Glyphosate ²	Glyphosate + 2,4-D ²	Glyphosate + Clarity ²	Glyphosate + Leadoff ²	Glyphosate + Sharpen ²	Glyphosate + Valor SX ²	Paraquat ²	Paraquat + 2,4-D ²	Paraquat + Clarity ²	Paraquat+ Valor SX ²	Liberty ²
barley, little	F	E	E	E	E	E	E	G	G	G	G	G
bluegrass, annual	G	F	F	F	E	E	E	G	G	G	G	P
buttercups	G	E	E	E	E	E	E	E	E	E	E	E
chickweed, common	G	F	G	GE	E	E	E	E	E	GE	E	E
clovers	P	PF	F	FG	G	E	F	G	G	GE	GE	F
cudweed	G	E	E	E	E	E	E	FG	FG	FG	FG	G
dandelion	P	P	E	E	E	G	G	N	E	GE	P	FG
dock, curly	P	PF	G	GE	F	F	G	F	FG	GE	P	G
eveningprimrose, cutleaf	GE	PF	E	GE	E	E	FG	F	E	GE	E	G
geranium, Carolina	GE	FG	E	E	E	E	E	GE	E	GE	E	GE
henbit/deadnettle	G	F	G	GE	E	E	E	G	GE	E	E	G
horseweed (maretail)	G	E	GE	E	GE	E	GE	F	GE	E	GE	GE
mustard, wild	G	FG	E	G	G	E	GE	FG	E	G	GE	GE
pansy, field	G	F	F	F	---	E	F	G	G	G	G	G
peanut, volunteer	F	F	F	G	P	GE	FG	P	F	GE	F	GE
pepperweed, Virginia	G	G	E	GE	E	E	G	G	GE	G	G	G
radish, wild	G	FG	GE	GE	G	E	GE	G	GE	GE	GE	GE
ryegrass, Italian	F	G	F	F	E	E	G	FG	FG	FG	FG	P
sorrel, red	F	E	E	E	G	G	E	E	E	E	E	PF
spurry, corn	G	GE	GE	GE	E	E	G	FG	G	G	G	---
swinecress	G	FG	G	G	E	E	FG	PF	FG	FG	PF	GE
vetch	GE	F	E	E	E	E	FG	G	GE	GE	GE	GE
wheat/rye cover crop	P	E	E	E	E	E	E	FG	F	F	G	F

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Herbicide rates for burndown are: ET/Aim at 1.0 oz/A; Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ae/gal); 2,4-D at 1-2 pt/A; Clarity at 8 oz/A; Leadoff at 1.5 oz/A; Sharpen at 1.0 oz/A; Gramoxone at 3.0 pt/A; Valor SX at 3.0 oz/A; and Liberty at 29 oz/A.

Managing Resistant Palmer Amaranth in Soybean¹

Palmer amaranth populations are resistant to acetolactate synthase (ALS) inhibiting herbicides (i.e., Harmony, Classic, and Python) and dinitroaniline (yellow) herbicides (i.e., Prowl, Treflan, and Sonalan), and glyphosate (i.e., Roundup). Dicamba and 2,4-D tolerant soybeans has allowed growers to use an additional mode-of-action to control glyphosate and ALS-resistant Palmer amaranth. Please read the labels and follow the recommended stewardship practices to maintain their future availability in soybean. Use of overlapping residual herbicides and rotation of postemergence herbicides will still be an important part of these new varieties.

Seed Program	PRE	1 st POST ²	2 nd POST
Roundup Ready	Valor SX ⁴ or Reflex ⁴	glyphosate + Reflex ⁴ or glyphosate + Flexstar ⁴ or glyphosate + Ultra Blazer ⁴ or glyphosate + Cobra ⁴ or Sequence	<i>Glyphosate + residual</i>
	Valor XLT ⁴ or Prefix ⁴ or Envive ⁴		
	Dual Magnum, Intrro, Outlook, Prowl ⁵ , Boundary, Fierce, Axiom, Zidua		
LibertyLink	Valor SX ⁴ or Reflex ⁴	glufosinate + Reflex ⁴ or glufosinate + Flexstar ⁴ or glufosinate + Ultra Blazer ⁴ or glufosinate + Cobra ⁴ glufosinate + Dual Magnum	<i>glufosinate + residual</i>
	Valor XLT ⁴ or Prefix ⁴ or Envive ⁴		
	Dual Magnum, Boundary, Axiom, Intrro, Outlook, Fierce, Zidua, Prowl ⁵		
Conventional	Prowl ⁵ , Valor SX ⁴ , Valor XLT ⁴ , or Reflex ⁴	Reflex ⁴ or Ultra Blazer ⁴ or Cobra ⁴	<i>If needed³</i>
	Canopy ⁶ , Boundary, Axiom, Intrro, Dual Magnum, Outlook, Boundary, Fierce, Zidua, or Prowl ⁵	Reflex ⁴ or Ultra Blazer ⁴ or Cobra ⁴	
	Prefix ⁴	Reflex ⁴ /Ultra Blazer ⁴ /Cobra ⁴	
XtendFlex/Enlist	Valor SX ⁴ or Reflex ⁴	Dicamba ⁷ /2,4-D Choline ⁸ + Glyphosate/Glufosinate + Warrant/Warrant Ultra/Reflex	Dicamba ⁷ /2,4-D Choline ⁸ + Glyphosate/Glufosinate + Warrant/Warrant Ultra
	Valor XLT ⁴ or Prefix ⁴ or Envive ⁴		
	Dual Magnum, Intrro, Outlook, Prowl ⁵ , Boundary, Fierce, Axiom, Zidua		

¹Glyphosate- and ALS-resistant Palmer amaranth biotypes are prevalent in South Carolina soybeans. An aggressive program of overlapping residuals and rotation of postemergence herbicide is necessary to slow the spread of resistance.

²When applied in combination with glyphosate (Roundup Ready) or Liberty (LibertyLink), use 16 oz/A of Reflex or Flexstar, 1.0 pt/A of Ultra Blazer, 12.5 oz/A of Cobra. Applications should be made before Palmer amaranth exceeds 2 inches in height.

³A second postemergence application may not be needed. If Reflex or was applied earlier, use Ultra Blazer or Cobra for a second application (If Roundup Ready, include glyphosate if needed for additional weeds). Do not make a second application of Reflex. Reflex may be preferred because of residual control of Palmer amaranth.

⁴Valor, Valor XLT (Valor + Classic), Envive (Valor + Harmony + Classic), Cobra, Prefix (Reflex + Dual Magnum), Reflex, Flexstar, and Ultra Blazer have the same mode of action (PPO inhibitor). Therefore, do not make more than 1 application of these herbicides in a single season.

⁵If Palmer amaranth is not controlled by Prowl, Treflan, or Sonalan (DNA-resistance); use Dual Magnum, Outlook, or Intrro instead.

⁶When using Canopy, follow label for soil pH restrictions and soybean variety tolerance.

⁷USE ONLY XTENDIMAX, ENGENIA, or TAVIUM DICAMBA HERBICIDES ON XTENDFLEX SOYBEAN VARIETIES. Do not use any other dicamba product on XTENDFLEX soybeans. Consult the tank mix websites for approved residual herbicide tank mix partners for DICAMBA.

⁸USE ONLY ON ENLIST (2,4-D TOLERANT) SOYBEAN VARIETIES. Consult the ENLIST websites for approved residual herbicide tank mix partners for ENLIST ONE and ENLIST DUO.

Weed Response to Soil Applied Herbicides for Soybean Weed Management¹

	PPI ²	PPI ² or PRE ³										
	Treflan/Sonalan	Authority MAXX	Authority MTZ	Axiom	Boundary	Canopy	Command	Dual Magnum	Intrro	Outlook	Prefix	Prowl
anoda, spurred	P	G	G	G	G	---	E	P	P	P	---	P
barnyardgrass	E	F	G	GE	GE	F	GE	GE	GE	GE	GE	E
beggarweed, Florida	P	G	G	G	G	G	---	P	F	P	P	P
bermudagrass	P	P	P	P	P	P	PF	P	P	P	P	P
citronmelon	P	---	---	F	F	F	G	P	P	P	---	P
cocklebur, common	P	F	G	F	F	GE	F	P	P	P	G	P
cowpea	P	P	P	P	F	F	P	P	P	P	P	P
crabgrass	E	F	F	E	E	G	E	E	E	E	E	E
crotalaria, showy	---	---	G	G	G	G	---	P	P	P	P	P
croton, tropic	P	---	---	GE	GE	G	G	P	P	P	FG	P
crowfootgrass	E	---	P	GE	GE	G	G	G	E	E	G	E
dayflower, Benghal	P	P	F	GE	GE	G	F	G	GE	G	E	P
eclipta	G	---	G	GE	GE	G	G	GE	GE	GE	G	G
goosegrass	E	F	FG	E	E	G	G	E	E	E	E	E
jimsonweed	P	G	G	GE	GE	G	FG	P	P	P	---	P
johnsongrass, seedling	E	F	F	GE	GE	P	F	F	F	F	PF	E
johnsongrass, rhizome	P	P	P	P	P	P	P	P	P	P	P	P
lambsquarters, common	GE	G	GE	GE	GE	GE	GE	F	F	FG	E	GE
morningglory spp.	P	E	E	G	G	G	P	P	P	P	PF	FP
nutsedge, purple	P	G	G	P	P	P	P	P	P	P	---	P
nutsedge, yellow	P	G	G	P	P	F	P	FG	F	F	GE	P
panicum, fall	E	F	P	GE	GE	---	G	G	G	G	E	E
panicum, Texas	GE	F	P	P	P	G	FG	P	P	P	F	GE
pigweed spp.	GE	GE	GE	G	GE	GE	PF	G	G	G	E	F
ALS-resistant	GE	GE	GE	G	GE	GE	PF	G	G	G	E	F
DNA-resistant	P	GE	GE	G	GE	GE	PF	G	G	G	E	P
poinsettia, wild	P	---	F	GE	GE	G	P	P	P	P	E	P
purslane, common	E	---	---	GE	GE	GE	G	G	---	---	G	E
pusley, Florida	E	---	---	E	E	E	FG	G	G	G	E	E
ragweed, common	P	F	GE	GE	GE	G	FG	P	PF	F	G	P
redweed	P	---	---	---	---	---	---	---	---	---	G	P
sandbur, field	E	F	---	GE	GE	P	F	G	G	FG	GE	E
senna, coffee	P	G	---	GE	GE	G	F	P	PF	P	P	P
sesbania, hemp	P	FG	P	GE	GE	GE	P	P	P	P	P	P
sicklepod	P	G	G	GE	GE	G	P	P	PF	P	P	P
sida, prickly	P	---	G	GE	GE	GE	G	F	G	P	P	P
signalgrass, broadleaf	G	F	F	GE	GE	FG	E	FG	FG	FG	G	G
smartweed, Pennsylvania	P	---	E	GE	G	G	E	P	P	P	F	P
spurge	P	---	GE	---	FG	---	GE	FG	FG	FG	F	P
starbur, bristly	P	---	---	GE	GE	G	---	P	F	P	E	P
velvetleaf	P	G	GE	GE	GE	G	E	P	P	P	F	P

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, 70% or less; --- = Insufficient Data.

²PPI = Preplant Incorporated

³PRE = Preemergence

Weed Response to Soil Applied Herbicides for Soybean Weed Management (cont.)¹

	PRE ³ or PPI ²					PRE ³									
	Pursuit	Python	Reflex	Scepter	Spartan	Envive	Fierce	Gangster	Linuron	Spartan Charge	Surveil	Valor SX	Valor XLT	Zidua/Anthem	Warrant
anoda, spurred	E	E	--	P	G	E	E	G	P	G	GE	F	E	--	--
barnyardgrass	P	P	P	P	F	P	E	P	GE	P	P	P	P	E	E
beggarweed, Florida	P	FG	P	P	E	GE	GE	GE	G	G	--	GE	GE	GE	F
bermudagrass	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
citronmelon	PF	--	--	P	--	G	G	G	--	G	P	G	G	G	--
cocklebur, common	G	GE	G	E	GE	FG	FG	F	P	GE	P	P	FG	P	P
crabgrass	P	P	FG	F	FG	P	P	P	G	FG	P	P	P	GE	E
crowfootgrass	P	P	--	P	F	P	P	P	G	F	P	P	P	GE	E
cowpea	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
crotalaria, showy	--	--	--	--	--	G	G	G	G	--	--	G	G	G	P
croton, tropic	--	--	FG	P	--	E	E	GE	PF	--	--	G	E	G	P
dayflower, Benghal	FG	--	P	--	--	FG	FG	FG	--	--	F	PF	F	FG	G
eclipta	G	G	GE	--	GE	GE	GE	GE	G	--	--	GE	GE	G	G
goosegrass	P	P	--	PF	FG	P	P	P	G	FG	P	P	P	GE	E
jimsonweed	GE	P	--	FG	E	E	E	GE	F	E	--	G	GE	G	F
johnsongrass, seedling	P	P	--	P	F	P	P	P	P	F	P	P	P	GE	P
johnsongrass, rhizome	P	P	--	P	P	P	P	P	P	N	P	P	P	P	P
lambsquarters, common	F	E	E	G	E	E	E	GE	GE	E	E	GE	GE	G	FG
morningglory spp.	GE	FG	F	FG	E	G	G	GE	G	E	E	FG	G	F	P
nutsedge, purple	G	P	P	PF	E	P	P	P	P	E	P	P	F	P	P
nutsedge, yellow	FG	P	GE	FG	E	P	P	P	P	E	P	P	FG	P	F
panicum, fall	P	P	--	PF	FG	P	P	P	F	FG	P	P	P	GE	G
panicum, Texas	P	P	F	F	F	P	P	P	PF	F	P	P	P	F	F
pigweed spp.	E	GE	GE	E	E	E	E	E	G	E	E	E	E	E	GE
ALS-resistant	E	GE	GE	E	E	E	E	E	G	E	E	E	E	E	GE
DNA-resistant	E	GE	GE	E	E	E	E	E	G	E	E	E	E	E	GE
poinsettia, wild	E	G	GE	G	--	GE	GE	GE	--	--	--	FG	G	FG	G
purslane, common	--	--	G	E	--	GE	GE	--	G	--	GE	GE	GE	--	G
pusley, Florida	GE	G	P	GE	FG	GE	GE	E	G	FG	P	GE	GE	G	GE
ragweed, common	P	FG	G	G	P	G	G	GE	G	P	GE	GE	G	G	P
redweed	--	G	--	--	--	GE	GE	GE	--	--	GE	GE	GE	--	--
sandbur, field	P	P	--	--	PF	P	P	P	G	PF	P	P	P	GE	FG
senna, coffee	FG	F	P	FG	--	FG	FG	G	--	--	P	PF	FG	P	P
sesbania, hemp	P	P	P	P	GE	G	G	GE	F	GE	P	G	E	G	P
sicklepod	P	G	P	F	P	F	F	P	P	P	P	P	F	P	P
sida, prickly	E	E	GE	GE	P	E	E	GE	F	P	FG	GE	E	GE	G
signalgrass, broadleaf	PF	P	FG	PF	F	P	P	P	P	F	P	P	P	FG	FG
smartweed, Pennsylvania	G	G	--	G	--	F	F	P	F	--	GE	F	F	G	P
spurge	--	--	--	--	--	--	--	--	--	--	GE	--	--	--	--
starbur, bristly	F	E	G	F	--	G	G	G	F	--	--	F	FG	F	P
velvetleaf	GE	GE	--	PF	GE	G	G	G	P	PF	GE	F	G	G	G

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, 70% or less; -- = Insufficient Data.

²PPI = Preplant Incorporated

³PRE = Preemergence

Preplant Incorporated Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>chloransulam-methyl</i> FirstRate 84WDG	0.3-0.6 oz	0.016-0.032 lb	2	65 days	12 hours
Comments: Incorporate to depth of 1 to 3 inches of the final seedbed using equipment that provides thorough soil mixing. Do not apply FIRSTRATE earlier than 4 weeks before planting (best results occur when done 2 weeks before planting).					
<i>ethalfuralin</i> Sonalan HFP Sonalan 10G	1.5-2.5 pt 5.5-9.5 lb	0.56-0.94 lb	3	---	24 hours
Comments: Apply SONALAN 2.0 to 3.0 pt/A for rhizome johnsongrass control. For better pigweed control, use 1.5 pt/A on coarse-textured soils and 2.0 pt/A on medium-textured soils. Incorporate to a depth of 2 to 3 inches immediately after application. Cross disk for best results. Do not use SCEPTER as a tank mix or as a follow-up postemergence application to SONALAN. Soybean should be planted no more than 2 inches deep after adverse weather conditions have occurred since application or crop injury may occur.					
<i>flufenacet</i> + <i>metribuzin</i> Axiom 68DF	7.0-13.0 oz	0.24-0.44 lb + 0.06-0.11 lb	15 5	120 days	12 hours
Comments: Incorporate uniformly within the top 1-2 inches of the soil zone up to 14 days before planting. Controls crabgrass, goosegrass, fall panicum, spurge, and purslane. Recommended tank mix partners for AXIOM include AUTHORITY BROADLEAF, CANOPY, COMMAND, FIRSTRATE, LINEX, PROWL, PYTHON, PURSUIT, SCEPTOR, SENCOR, SONALAN, or TREFLAN. AXIOM contains metribuzin which has the potential to injure some varieties of soybeans, consult label for more details. Do not apply more than 13 oz AXIOM per acre per season.					
<i>flumetsulam</i> Python 80WDG	0.8-1.14 oz	0.04-0.057 lb	2	85 days	12 hours
Comments: Incorporate to a depth of 2 to 3 inches deep in the soil zone. Controls several annual broadleaf weeds including lambsquarters, pigweeds, and prickly sida; generally, provides control of light to moderate infestations of Florida beggarweed, common ragweed, and sicklepod. Marginal control of annual morningglory. Tank mix with PROWL or TREFLAN for improved annual grass control.					
<i>imazaquin</i> Scepter 70DF	2.8 oz	0.12 lb	2	90 days	12 hours
Comments: Apply and incorporate 1 to 2 inches deep in the soil zone. Controls Florida beggarweed, annual morningglory, <i>glyphosate-resistant Palmer amaranth</i> , and Florida pusley. Tank mix with PROWL or TREFLAN for grass control. Do not apply CLASSIC, CANOPY, SQUADRON, SYNCHRONY, PURSUIT PLUS, or PURSUIT to field previously treated with SCEPTER. Do not plant cotton within 18 months of application.					
<i>imazethapyr</i> Pursuit 2AS	4.0 oz	0.063 lb	2	85 days	4 hours
Comments: Incorporate to a depth of 2 to 3 inches in the soil zone. Controls annual broadleaf weeds and suppresses nutsedge. Tank mix with PROWL or TREFLAN for improved annual grasses control. PURSUIT should only be applied once per season to soybeans. Do not apply CLASSIC, CANOPY, or SCEPTER to field previously treated with PURSUIT. Do not tank mix with COMMAND.					
<i>metribuzin</i> Metribuzin 75DF Tricor DF	0.33-0.5 lb	0.25-0.375 lb	6		12 hours
Comments: Controls bristly starbur, crabgrass, crowfootgrass, Florida pusley, pigweeds, hemp sesbania, and sicklepod. Rates are dependent on soil type. Consult label for more details. Incorporate to a depth of 1-2 inches deep in the soil zone. Do not use on loamy sands or sandy loams with less than 0.5% organic matter. Plant soybean at least 1.5 inches deep to avoid potential crop injury.					

Preplant Incorporated Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>metribuzin</i> +		0.24-0.32 lb	5	---	12 hours
<i>chlorimuron</i> Canopy 75DF	6.0-8.0 oz	0.04-0.05 lb	2		
Comments: Incorporate to a depth of 1 to 2 inches in the soil zone. Tank mix with TREFLAN, PROWL, or SONALAN for improved grass control. Use lower rate on sandy soils. CANOPY contains metribuzin which has the potential to injure sensitive soybean varieties, consult seed dealer regarding injury potential. Do not tank mix CANOPY with soil-applied organophosphate insecticides. Do not apply CANOPY within 14 days before or after an application of an organophosphate insecticide as severe crop injury may occur.					
<i>pendimethalin</i> Prowl 3.3EC Prowl H ₂ O 3.8EC	1.8-2.1 pt 1.5-2.1 pt	0.74-0.87 lb 0.71-1.0 lb	3	21 days	24 hours
Comments: Use to control annual grasses, seedling johnsongrass and Florida pusley. Incorporate in the 2 to 3 inches of the seedbed within in 7 days of application; immediate incorporation suggested. Mechanical incorporation is not required if rain event of 0.5 inch or greater occurs within 7 days of application. Do not exceed 2.1 pt/A per application.					
<i>pyroxasulfone</i> Zidua 85WG Zidua SC 4.17SC	1.5-3.0 oz 2.5-5.0 fl oz.	0.080-0.159 lb 0.081-0.162 lb	15	None	12 hours
Comments: Apply ZIDUA to the soil surface and incorporate up to 14 days prior to planting soybeans. For enhanced residual control of weeds in reduced tillage fields, tank mix with PROWL H ₂ O, PURSUIT, and SCEPTER. Do not apply more than 2.1 oz/A of ZIDUA per cropping season on coarse textured soils. Do not make more than one application of ZIDUA to soybean in the spring. Plant a minimum of 1 inch deep.					
<i>pyroxasulfone</i> +		0.082-0.163 lb	15	---	12 hours
<i>fluthiacet-methyl</i> Anthem 2.15EC	5.0-10.0 fl oz	0.003-0.006 lb	14		
Comments: Incorporate ANTHEM into the upper (1-2 inches) soil surface up to 14 days before planting. Deeper incorporation may increase the potential for crop injury and may result in reduced weed control. Use appropriate equipment that provides uniform shallow incorporation, such as a field cultivator, harrow, rolling cultivator, or finishing disc.					
<i>s-metolachlor</i> Dual Magnum 7.62EC EverpreX 7.62EC	1.0-1.33 pt	0.95-1.27 lb	15	100 days	24 hours
Comments: Incorporate to a depth of 1 to 2 inches in the soil zone. Excellent control of annual grasses and small seeded broadleaves. Tank mix partners include LOROX, CANOPY, SCEPTER, PURSUIT, SONOLAN, or SENCOR.					
<i>s-metolachlor</i> +		0.79-1.38 lb	15	160 days	12 hours
<i>metribuzin</i> Boundary 6.5EC	1.2-2.1 pt	0.19-0.33 lb	5		
Comments: Incorporate uniformly within the top 2 inches of the soil zone. Use rate is dependent on soil type, check label for details. Not recommended for use on sands with less than 1.0% organic matter. Can be tank mixed with PYTHON, SCEPTER, CANOPY, COMMAND, or PROWL. BOUNDARY contains metribuzin which has the potential to injure sensitive soybean varieties, consult seed dealer regarding injury potential. Do not use BOUNDARY in conjunction with soil-applied organophosphate insecticides.					

Preplant Incorporated Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>sulfentrazone</i>		0.14-0.25 lb	14	None	12 hours
Spartan 4F	4.5-8.0 fl oz				

Comments: Apply SPARTAN 4F to the soil surface and incorporate to a depth of 2 inches. Do not incorporate deeper than 2 inches. Improper soil incorporation may result in erratic weed control and/or crop injury. Excellent control of morningglory, pigweed, lambsquarters, and yellow nutsedge. Tank mix with PROWL, TREFLAN, or DUAL MAGNUM for improved annual grass control. Do not apply more than 12 fl oz/A of SPARTAN per 12-month period. Do not apply SPARTAN to soils classified as sands with less than 1.0% organic matter.

<i>sulfentrazone</i>		0.194-0.290 lb	14	---	12 hours
+		+			
<i>chlorimuron ethyl</i>		0.016-0.019 lb	2		
Authority MAXX 66DF	5.0-7.5 oz				

Comments: Uniformly incorporate AUTHORITY MAXX no deeper than the top 2 inches of the soil profile prior to planting soybeans. Improper incorporation can lead to erratic weed control and/or crop injury. Use rate is dependent on soil texture, consult label for more details. Do not apply AUTHORITY MAXX to coarse sand soils with less than 1.0% organic matter. Do not follow AUTHORITY MAXX with a postemergence application of another chlorimuron-ethyl containing herbicide in the same cropping season. Do not tank mix AUTHORITY MAXX with organophosphate insecticides.

<i>sulfentrazone</i>		0.14-0.18 lb	14	120 days	12 hours
+		+			
<i>metribuzin</i>		0.20-0.27 lb	5		
Authority MTZ 45DF	12-16 oz				

Comments: Incorporate uniformly within the top 2 inches of the soil profile. Do not incorporate deeper than 2 inches. Use rate is dependent on soil texture, consult label for more details. Do not apply AUTHORITY MTZ to coarse soils with less than 1.0% organic matter. A lower rate (8 to 10 oz/A) of AUTHORITY MTZ is recommended in glyphosate-tolerant soybean production systems. Do not apply more than 33 oz of AUTHORITY MTZ per acre per season (12 months from the first application). AUTHORITY MTZ contains metribuzin which has the potential to injure some varieties of soybeans, consult label for more details.

<i>sulfentrazone</i>		0.104-0.175 lb			
+		+			
<i>s-metolachlor</i>		0.94-1.58 lb			
Broadaxe XC 7EC	19-32 fl oz				

Comments: Incorporate uniformly within the top 2 inches of the soil profile up to 14 days before planting. Control pigweed, morningglories, fall panicum, broadleaf signalgrass, and lambsquarters. Do not incorporate deeper than 2 inches. Use rate is dependent on soil texture and organic matter content, consult label for more details. Do not apply BROADAXE XC to soils classified as sand which have less than 1.0% organic matter. Do not apply more than 38.7 fl. oz per acre of BROADAXE XC per crop year. Do not graze or feed treated soybean forage, hay or straw to livestock for 30 days after treatment. Do not apply after crop seed germination.

<i>trifluralin</i>		0.5-0.75 lb	3	60 days	12 hours
Treflan 4EC	1.0-1.5 pt				
Treflan TR-10G	5.0-7.5 lb				

Comments: Controls annual grasses and some small-seeded broadleaf weeds, seedling johnsongrass. Use 2.0 to 3.0 pt/A for rhizome johnsongrass control. For enhanced Palmer amaranth control, use the 1.5 pt/A rate. Incorporate TREFLAN to a depth of 2 to 3 inches within 24 hours after application. Cross disk for best results. Soybean should not be planted after adverse weather conditions have occurred since application or crop injury may occur.

Preemergence Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i>		0.94-1.5 lb	15	---	12 hours
Warrant 3.0ME	1.25-2.0 qt				

Comments: Provides residual control of small seeded broadleaves (including glyphosate-resistant Palmer amaranth) and grasses. Apply after planting but before weeds germinate. The optimum rate of WARRANT is 3 pt/A. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE or PARAQUAT to control weeds that have germinated since planting. Environmental conditions that follow application of WARRANT including cold, wet soils or saturated conditions from excessive rain may result in crop injury. Do not apply *acetochlor* within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. These restrictions do not apply to areas outside of the 50ft distance to the well.

<i>acetochlor</i>		1.07 lb	15	45 days	12 hours
+		+			
<i>fomesafen</i>		0.24 lb	14		
Warrant Ultra 3.45ME	48 fl oz				

Comments: Apply WARRANT ULTRA after planting soybeans but before weeds germinate. Environmental conditions that follow application of WARRANT ULTRA including cold, wet soils or saturated conditions from excessive rain may result in crop injury. Do not apply *acetochlor* within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. These restrictions do not apply to areas outside of the 50ft distance to the well.

<i>carfentrazone</i>		0.015-0.026 lb	14	None	12 hours
+		+			
<i>sulfentrazone</i>		0.14-0.21 lb	14		
Spartan Charge 3.5S	5.5-8.5 fl oz				

Comments: Apply SPARTAN CHARGE to the soil surface prior to planting or up to 3 days after planting. Do not apply SPARTAN CHARGE after 3 days because injury may occur as seeds are germinating. SPARTAN CHARGE will provide postemergence activity on weeds (less than 3 inches in height) present at the time of application. Sprayer calibration and good agitation are essential with application of SPARTAN CHARGE. Excellent control of morningglory, pigweeds, lambsquarters, and yellow/purple nutsedge. Tank mix with PROWL, OUTLOOK, or DUAL MAGNUM for improved annual grass control. Do not apply more than 8.5 fl oz/A of SPARTAN CHARGE per 12-month period. Do not apply SPARTAN CHARGE to soils classified as sands with less than 1.0% organic matter.

<i>chloransulam methyl</i>		0.026-0.032 lb	2	65 days	12 hours
+		+			
<i>flumioxazin</i>		0.079-0.095 lb	14		
Surveil 48WG	3.5-4.2 oz				

Comments: Apply SURVEIL to the soil surface prior to planting, at planting, or up to 3 days after planting. Application after soybeans have begun to crack or are emerged will result in severe crop injury. Do not tank mix SURVEIL with a group 15 herbicide such as WARRANT, MICRO-TECH, AXIOM, DOMAIN, BOUNDARY, DUAL MAGNUM, DUAL II MAGNUM, FRONTIER, or OUTLOOK within 14 days of planting soybeans unless soybeans are planted under no-till or minimum tillage conditions on wheat stubble or no-till field corn stubble. For additional spectrum of weed control, SURVEIL may be tank mixed with METRIBUZIN, LOROX, PROWL, or COMMAND. Do not irrigate when soybeans are cracking. Do not apply more than 4.2 oz of SURVEIL per acre during a growing season. Spray equipment must be cleaned each day following SURVEIL application.

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>chlorimuron-ethyl</i> + <i>flumioxazin</i> + <i>thifensulfuron</i> Envive 41.3DF		0.014-0.023 lb + 0.046-0.073 lb + 0.005-0.007 lb	2 14 2	---	12 hours
Comments: ENVIVE controls tropic croton, <i>ALS- and glyphosate-resistant Palmer amaranth</i> , and Florida beggarweed. A single postemergence application in soybeans of CLASSIC or SYNCHRONY XP at up to 0.75 oz/A is allowed after preemergence application of ENVIVE. For grass weeds, tank mix with PROWL or COMMAND. Do not apply ENVIVE 14 days before or after a soil organophosphate application unless soybean variety is STS or STS/RR. Do not irrigate soybean treated with ENVIVE during cracking. Do not tank mix ENVIVE with acetochlor (WARRANT) or flufenacet (AXIOM) or dimethenamid-p (OUTLOOK) products within 14 days of planting soybeans, unless soybeans are planted under no-till or minimum tillage conditions on wheat stubble or no-till field corn stubble. <i>Be sure clean-out ENVIVE from the sprayer after each day's use and before spraying any other crop.</i>					
<i>chlorimuron-ethyl</i> + <i>flumioxazin</i> + <i>metribuzin</i> Trivence 61.3 WDG		0.020-0.024 lb + 0.064-0.080 lb + 0.223-0.279 lb	2 14 5	None	12 hours
Comments: Apply TRIVENCE to the soil surface prior to planting, at planting, or up to 3 days after planting. Do not apply more than 8.7 oz/A of TRIVENCE on coarse textured soils. Do not exceed 9.0 oz/A of TRIVENCE on soils with a composite pH of 7.0 or greater. Controls several broadleaf weeds including <i>ALS-and glyphosate-resistant Palmer amaranth</i> , prickly sida, and tropic croton. For additional weed control spectrum, TRIVENCE may be tank mixed with COMMAND, <i>linuron</i> , <i>metribuzin</i> , <i>pendimethalin</i> , or <i>pyroxasulfone</i> . Do not tank mix TRIVENCE with <i>metolachlor</i> (DUAL MAGNUM, BOUNDARY), <i>dimethenamid-p</i> (Outlook) or <i>flufenacet</i> (AXIOM) or soybean injury may occur especially when application is followed by prolonged periods of cool, wet weather. Do not apply TRIVENCE within 14 days before or after an application of an organophosphate insecticide on any soybean variety that is not STS or STS/RR as severe crop injury may occur. Do not irrigate soybeans during cracking. <i>Be sure to follow the clean-out instructions for removing TRIVENCE from the sprayer after each day's use; do not let spray solution sit overnight in the tank.</i>					
<i>chloransulam-methyl</i> FirstRate 84WDG	0.3-0.6 oz	0.016-0.032 lb	2	65 days	12 hours
Comments: Apply FIRSTRATE after planting but prior to crop or weed emergence. Controls bristly starbur, annual morningglory, common ragweed, and sicklepod. Weak on Palmer amaranth. FIRSTRATE may be tank mixed with other herbicides labeled for preemergence use in soybeans.					
<i>clomazone</i> Command 3ME	2.0-3.33 pt	0.75-1.25 lb	13	9 days	12 hours
Comments: Controls crabgrass, fall panicum, Texas panicum, velvetleaf, spurred anoda, annual morningglory, and prickly sida. Provides only marginal suppression of most other broadleaf weeds (<i>Palmer amaranth</i>). May be tank mix with CANOPY, DUAL, INTRRO, LOROX, PROWL, PURSUIT, or SCEPTER to enhance weed control spectrum. Do not apply in the air or within 300 ft of housing developments, commercial fruit, vegetable, or nut production, or commercial ornamental nurseries or greenhouses.					

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>dimethenamid-p</i> Outlook 6EC	8-12 fl oz	0.38-0.56 lb	15	80 days	12 hours
Comments: OUTLOOK controls some small seeded annual grasses broadleaf weeds. Provides some suppression of sicklepod. May be tank mixed with PROWL for improved grass control including Texas panicum. Apply after planting and before crop and weeds emerge. Do not exceed 21 oz/A/year of OUTLOOK.					
<i>flufenacet</i> +		0.24-0.44 lb	15	120 days	12 hours
<i>metribuzin</i> Axiom 68DF	7.0-13.0 oz	0.06-0.11 lb	5		
Comments: Controls crabgrass, goosegrass, fall panicum, spurge, and purslane. Recommended tank mix partners include AUTHORITY BROADLEAF, CANOPY, COMMAND, FIRSTRATE, LINEX, PROWL, PYTHON, PURSUIT, SCEPTOR, SENCOR, or SONALAN, or TREFLAN. AXIOM contains metribuzin which has the potential to injure some varieties of soybeans, consult label for more details. Do not apply more than 13 oz AXIOM per acre per season.					
<i>flumetsulam</i> Python 80WDG	0.89-1.14 oz	0.045-0.057 lb	2	85 days	12 hours
Comments: Controls several annual broadleaf weeds including lambsquarters, pigweeds, and prickly sida; generally, provides control of light to moderate infestations of Florida beggarweed, common ragweed, and sicklepod. Marginal control of annual morningglory. Tank mix with PROWL, OUTLOOK, or DUAL MAGNUM for improved annual grass control.					
<i>flumioxazin</i> Valor SX 51WDG Rowel 51WDG Valor EZ 4SC	2.0-3.0 oz 2.0-3.0 fl oz	0.064-0.096 lb	14	60 days	12 hours
Comments: Apply VALOR/ROWEL to soybean prior to planting, at planting, or up to 3 days after planting. Controls several broadleaf weeds including <i>ALS-and glyphosate-resistant Palmer amaranth</i> , prickly sida, and tropic croton. For additional residual grass and broadleaf control, tank mix with COMMAND, FIRSTRATE, LOROX, PURSUIT PLUS, PYTHON, <i>pendimethalin</i> , SQUADRON, or SCEPTER. Do not apply more than 3 oz/A of VALOR/ROWEL during a single growing season. Do not tank mix VALOR/ROWEL with <i>metolachlor</i> (DUAL MAGNUM, BOUNDARY), <i>dimethenamid-p</i> (Outlook), <i>alachlor</i> (INTRRO), or <i>flufenacet</i> (AXIOM, DOMAIN) or soybean injury may occur especially when application is followed by prolonged periods of cool, wet weather. Do not irrigate soybeans during cracking. <i>Be sure to follow the clean-out instructions for removing VALOR/ROWEL from the sprayer after each day's use; do not let VALOR/ROWEL sit overnight in the tank.</i>					
<i>flumioxazin</i> +		0.139-0.234 lb	14	---	12 hours
<i>chlorimuron-ethyl</i> Rowel FX 40.3WDG Valor XLT 40.3WDG	3.0-5.0 oz	0.048-0.080 lb	2		
Comments: Controls several broadleaf weeds including <i>ALS-and glyphosate-resistant Palmer amaranth</i> , prickly sida, and tropic croton. For enhanced residual control of broadleaf weeds in reduced tillage fields, tank mix with DUAL, METRIBUZIN, LINURON, or WARRANT. Areas (i.e., in the crop rows) that are excessively disturbed by the planting operation may see diminished weed control. Do not apply VALOR XLT/ROWEL FX within 14 days before or after an application of an organophosphate insecticide on any soybean variety that is not STS or STS/RR. For enhanced grass activity, tank mix PROWL or COMMAND. Do not tank mix VALOR XLT/ROWEL FX with metolachlor (DUAL MAGNUM, BOUNDARY), dimethenamid-p (Outlook),alachlor (INTRRO), or flufenacet (AXIOM, DOMAIN) or soybean injury may occur especially when application is followed by prolonged periods of cool, wet weather. Do not apply more than 5 oz/A of VALOR XLT per growing season. Do not use VALOR XLT/ROWEL FX on soils with a composite pH of greater than 7.6. <i>Be sure to follow the clean-out instructions for removing VALOR XLT/ ROWEL FX from the sprayer after each day's use; do not let VALOR XLT/ROWEL FX sit overnight in the tank.</i>					

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>flumioxazin</i> Gangster V 51 WDG +	1.5-3.0 oz	0.048-0.096 lb	14	---	12 hours
<i>chloransulam</i> Gangster FR 84DF	0.3-0.6 oz	0.016-0.032 lb	2		
Comments: Apply GANGSTER at planting or within 3 days of planting. Controls Florida beggarweed, ALS- and glyphosate-resistant Palmer amaranth, and annual morningglories. For additional preemergence grass weed control, tank mix with PROWL or COMMAND. Do not apply more than 3.0 oz/A of GANGSTER V and 0.6 oz/A of GANGSTER FR per growing season. Do not irrigate soybean treated with GANGSTER during cracking. <i>Be sure to follow the clean-out instructions for removing GANGSTER from the sprayer after each day's use; do not let GANGSTER sit overnight in the tank.</i>					
<i>flumioxazin</i> +		0.063-0.079 lb	14	---	12 hours
<i>pyroxasulfone</i> Fierce 76DF Fierce EZ 2.04SC	3.0-3.75 oz 6.0-9.0 fl oz	0.080-0.100 lb	15		
Comments: Apply FIERCE within 3 days of planting and prior to soybean emergence. Do not apply more than 3.75 oz/A of FIERCE during a single growing season. Tank mix partners for additional grass and broadleaf weed control include CHLORIMURON, COMMAND, GANGSTER, METRIBUZIN, FIRSTRATE, LOROX, PURSUIT PLUS, PENDIMETHALIN, PYTHON, SCEPTER, VALOR, and VALOR XLT. Spray equipment, including mixing vessels and nurse tanks, must be cleaned each day following FIERCE application; <i>do not let FIERCE sit overnight in the tank.</i>					
<i>fomesafen</i> Reflex 2EC	1.0-1.5 pt	0.25-0.375 lb	14	70 days	24 hours
Comments: Controls glyphosate- and ALS-resistant Palmer amaranth, annual morningglory, bristly starbur, and other broadleaf weeds. Tank mix PROWL, BOUNDARY, or DUAL MAGNUM for increased grass activity. Do not exceed 1.5 pt/A (0.375 lb ai/A) of REFLEX per calendar year.					
Resistance Management: Make only <u>one</u> application of a group 14 containing herbicide such as fomesafen (REFLEX, PREFIX, FLEXSTAR GT) or flumioxazin (VALOR) per growing season.					
<i>imazaquin</i> Scepter 70DF	2.8 oz	0.12 lb	2	90 days	12 hours
Comments: Controls Florida beggarweed, annual morningglory, glyphosate-resistant Palmer amaranth, and Florida pusley. Tank mix with PROWL, TREFLAN, OUTLOOK, or other labeled herbicides for grass control. Do not apply CLASSIC, CANOPY, SQUADRON, SYNCHRONY, PURSUIT PLUS, or PURSUIT to field previously treated with SCEPTER. Do not plant cotton within 18 months of application.					
<i>imazethapyr</i> Pursuit 70DF Pursuit 2AS	1.44 oz 4.0 oz	0.063 lb	2	85 days	4 hours
Comments: Controls annual broadleaf weeds and provides some nutsedge suppression. Tank mix with PROWL, DUAL MAGNUM, or OUTLOOK for improved annual grasses control. PURSUIT should only be applied once per season to soybeans. Do not apply CLASSIC, CANOPY, or SCEPTER to field previously treated with PURSUIT. Do not tank mix with COMMAND.					

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>linuron</i>		0.5-1.0 lb	7	57 days	24 hours
Lorox 50DF	1.0-2.0 lb				
Linex 4L	1.0-2.0 pt				

Comments: Controls Florida beggarweed, crabgrass, common ragweed, and pigweed. Rate is dependent on soil type, consult label for details. For broad spectrum weed control, labeled tank mix partners include DUAL MAGNUM, SYNCHRONY XP, CLASSIC, PROWL, BOUNDARY, or GANGSTER. Plant soybean at least 1" deep to avoid potential crop injury.

<i>metribuzin</i>		0.25-0.375 lb	6	70 days	12 hours
Metribuzin 75D	0.33-0.5 lb				
Tricor DF					

Comments: Controls bristly starbur, crabgrass, crowfootgrass, Florida pusley, pigweeds, hemp sesbania, and sicklepod. Rates are dependent on soil type. Consult label for more details. Tank mix with PROWL, DUAL MAGNUM, or SONOLAN for enhanced grass activity. Do not use on coarse soils with less than 0.5% organic matter. Plant soybean at least 1.5 inches deep to avoid potential crop injury.

<i>metribuzin</i>		0.24-0.32 lb	5	---	12 hours
+		+			
<i>chlorimuron</i>		0.04-0.05 lb	2		
Canopy 75DF	6.0-8.0 oz				

Comments: Controls *glyphosate-resistant Palmer amaranth*, prickly sida, and wild mustard, and several other broadleaf weeds. Tank mix with DUAL MAGNUM, PROWL, or INTRRO for improved grass control. Use lower rate on sandy soils. CANOPY contains metribuzin which has the potential to injure sensitive soybean varieties, consult seed dealer regarding injury potential. Do not tank mix CANOPY with soil-applied organophosphate insecticides. Do not apply CANOPY within 14 days before or after an application of an organophosphate insecticide as severe crop injury may occur.

<i>pendimethalin</i>			3	21 days	24 hours
Prowl 3.3EC	1.8-2.4 pt	0.74-0.99 lb			
Prowl H ₂ O 3.8EC	1.5-2.0 pt	0.71-0.95 lb			

Comments: Controls annual grasses and small-seeded broadleaf weeds. Apply at planting or up to 2 days after planting. If your field has a history of poor Palmer amaranth control with yellow herbicides, consider tank mixing with BOUNDARY or VALOR. Good control of Florida pusley. Effective for Brazil pusley emerging from seed but not effective against plants growing from root stock. Do not exceed one application per crop season at the highest rate per acre for any given soil type.

<i>pyroxasulfone</i>			15	None	12 hours
Zidua 85WG	1.5-3.0 oz	0.080-0.159 lb			
Zidua SC 4.17SC	2.5-5.0 fl oz	0.081-0.163 lb			

Comments: Apply ZIDUA to the soil surface after planting and before the crop emergence. Soybean seed must be planted at a minimum of 1.0 inch deep. The use of ZIDUA may result in temporary growth suppression in soybean if extreme conditions of high rainfall and extended periods of water saturated soil occur during soybean germination or early seedling development. ZIDUA may be tank mixed with OUTLOOK, PROWL H₂O, PURSUIT, VERDICT. Do not apply more than 2.1 oz/A of ZIDUA per cropping season on coarse textured soils. Do not make more than one application of ZIDUA to soybean in the spring.

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>pyroxasulfone</i> +		0.082-0.155 lb +	15	---	12 hours
<i>fluthiacet-methyl</i> Anthem 2.15EC	5.0-9.5 fl oz	0.003-0.005 lb	14		
Comments: Apply ANTHEM from planting through the third trifoliolate stage (V3). Under high moisture conditions the crop may experience some temporary crop response. The crop will rapidly outgrow these effects and develop normally with no reduction in yield. On coarse textured soils (with less than 3% organic matter), do not apply more than 6.8 oz/A of ANTHEM per cropping season. On other soil types, do not apply more than 11.4 oz/A of ANTHEM per cropping season.					
<i>proxysulfone</i> +		0.098-0.159 lb +	15	---	12 hours
<i>sulfentrazone</i> Authority Supreme 4.16SC	6.0-9.8 fl oz.	0.098-0.159 lb	14		
Comments: Apply AUTHORITY SUPREME at planting or within 3 days of planting, but before soybean cracking (emergence). Use rate is dependent on soil texture, consult label for more details. Do not apply more than 6.9 fl oz/A of AUTHORITY SUPREME on coarse textured soils. Ensure proper seed furrow closure after planting to minimize crop injury potential. Excessive rainfall, irrigation, or prolonged wet soil conditions after application of AUTHORITY SUPREME from seed germination through seedling emergence may increase the risk of soybean seedling injury.					
<i>s-metolachlor</i> Dual Magnum 7.62EC EverpreX 7.62EC	1.0-1.33 pt	0.95-1.27 lb	15	100 days	24 hours
Comments: Excellent control of annual grasses and small seeded broadleaves. Poor activity on large-seeded broadleaves like sicklepod and morningglory. Tank mix with LOROX, CANOPY, COMMAND, SCEPTER, PURSUIT, or SENCOR to improve spectrum of weed control.					
<i>s-metolachlor</i> +		1.09 lb +	15	80 days	24 hours
<i>fomesafen</i> Prefix 5.29EC	2.0 pt	0.24 lb	14		
Comments: Excellent control of <i>glyphosate- and ALS-resistant Palmer amaranth</i> , bristly starbur, and crabgrass. Apply during or immediately after planting before soybeans or weeds emerge. Dry weather after application may reduce PREFIX effectiveness.					
<i>s-metolachlor</i> +		0.79-1.38 lb +	15	40 days	12 hours
<i>metribuzin</i> Boundary 6.5EC	1.2-2.1 pt	0.19-0.33 lb	5		
Comments: Controls Florida pusley, crabgrass, crowfootgrass, pigweed spp., and bristly starbur. Use rate is dependent on soil type, check label for details. BOUNDARY contains metribuzin which has the potential to injure sensitive soybean varieties, consult seed dealer regarding injury potential. Do not use BOUNDARY in conjunction with soil-applied organophosphate insecticides. Soybeans may be injured by preemergence applications of BOUNDARY if they are not planted at least 1.5 inches deep. Do not use BOUNDARY on soils with less than 0.5% organic matter.					
<i>sulfentrazone</i> Spartan 4F	4.5-8.0 fl oz	0.14-0.25 lb	14	None	12 hours
Comments: Apply SPARTAN 4F to the soil surface prior to planting or up to 3 days after planting. Do not apply SPARTAN after 3 days because injury may occur as seeds are germinating. Excellent control of morningglory, pigweed, lambsquarters, and yellow nutsedge. Tank mix with PROWL, OUTLOOK, or DUAL MAGNUM for improved annual grass control. Do not apply more than 12 fl oz/A of SPARTAN per 12-month period. Do not apply SPARTAN to soils classified as sands with less than 1.0% organic matter.					

Preemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>sulfentrazone</i>		0.116-0.193 lb	2	65 days	12 hours
+		+			
<i>chloransulam-methyl</i>		0.015-0.025 lb	14		
Sonic 70DG	3.0-5.0 oz				

Comments: Apply SONIC to the soil surface prior to planting, at planting, or up to 3 days after planting. Properly closed seed furrows are necessary when applying at planting. Do not apply SONIC to soils classified as sands containing less than 1% organic matter. Do not feed treated soybean forage or soybean hay to livestock. Do not make more than one soil application per crop year. Do not apply more than 8 oz of SONIC per acre per season.

<i>sulfentrazone</i>		0.194-0.290 lb	14	---	12 hours
+		+			
<i>chlorimuron ethyl</i>		0.016-0.019 lb	2		
Authority MAXX 66DF	5.0-7.5 oz				

Comments: Apply AUTHORITY MAXX at planting or within 3 days of planting, but before soybean cracking (emergence). The seed furrow should be completely closed, and seed covered before any application of AUTHORITY MAXX. Use rate is dependent on soil texture, consult label for more details. Do not apply AUTHORITY MAXX to soils classified as sand which have less than 1.0% organic matter. Do not follow AUTHORITY MAXX with a postemergence application of another chlorimuron-ethyl containing herbicide in the same cropping season. Do not tank mix AUTHORITY MAXX with organophosphate insecticides.

<i>sulfentrazone</i>		0.104-0.175 lb	14	30 days	24 hours
+		+			
<i>s-metolachlor</i>		0.94-1.58 lb	15		
Broadaxe XC 7EC	19-32 fl oz				

Comments: Apply BROADAXE XC to the soil surface prior to planting, at planting, or up to 3 days after planting Controls pigweed, morningglories, fall panicum, broadleaf signalgrass, and lambsquarters. Use rate is dependent on soil texture and organic matter content, consult label for more details. Do not apply BROADAXE XC to soils classified as sand which have less than 1.0% organic matter. Do not apply more than 38.7 fl. oz per acre of BROADAXE XC per crop year. Do not graze or feed treated soybean forage, hay or straw to livestock for 30 days after treatment. Do not apply after crop seed germination.

<i>sulfentrazone</i>		0.14-0.18 lb	14	120 days	12 hours
+		+			
<i>metribuzin</i>		0.20-0.27 lb	5		
Authority MTZ 45DF	12-16 oz				

Comments: Apply AUTHORITY MTZ at planting or within 3 days of planting, but before soybean cracking (emergence). Use rate is dependent on soil texture, consult label for more details. Do not apply AUTHORITY MTZ to soils classified as sand which have less than 1.0% organic matter. A lower rate (8 to 10 oz/A) of AUTHORITY MTZ is recommended in glyphosate- or glufosinate-tolerant soybean production systems. Do not apply more than 20 oz of AUTHORITY MTZ per acre per season (12 months from the first application). AUTHORITY MTZ contains metribuzin which has the potential to injure some varieties of soybeans, consult label for more details.

Weed Response to Postemergence Herbicides for Soybean Weed Management¹

	Aim/ET	Assure II	Basagran	Cadet	Classic	Cobra	Dicamba ²	Enlist Duo ³	Enlist One ³	FirstRate	Flexstar	Flexstar GT ⁴	Fusilade DX	Fusion	Glyphosate ⁴	Harmony
anoda, spurred	F	P	G	---	F	F	G	GE	G	F	F	E	P	P	GE	P
barnyardgrass	G	GE	F	G	P	P	P	E	P	P	G	E	E	E	E	---
beggarweed, Florida	F	P	P	G	E	P	G	E	G	FG	P	G	P	P	G	---
bermudagrass	P	GE	P	P	P	P	P	F	P	P	P	G	G	G	G	P
citronmelon	P	P	P	P	---	G	G	GE	G	---	---	G	P	P	G	P
cocklebur, common	GE	P	E	---	E	GE	E	E	E	E	E	E	P	P	E	FG
cowpea	P	P	P	P	G	P	E	E	E	P	F	FG	P	P	G	P
crabgrass	P	E	P	P	P	P	P	E	P	P	P	E	G	GE	E	P
crotalaria, showy	F	P	P	F	---	E	G	G	E	---	GE	GE	P	P	GE	---
croton, tropic	G	P	P	---	P	G	GE	E	E	P	G	E	P	P	GE	P
crowfootgrass	P	E	P	P	P	P	P	E	P	P	P	E	FG	GE	E	P
dayflower, Benghal	P	P	---	---	F	---	P	FG	P	---	---	---	P	P	G	---
eclipta	FG	P	FG	FG	---	GE	G	E	G	---	GE	E	P	P	E	---
goosegrass	P	E	P	P	P	P	P	E	P	P	P	E	G	GE	E	P
jimsonweed	GE	P	E	---	GE	GE	E	E	E	E	E	E	P	P	E	F
johnsongrass, seedling	P	E	P	P	P	P	P	E	P	P	P	E	GE	GE	E	P
johnsongrass, rhizome	P	G	P	P	P	P	P	GE	P	P	P	E	GE	G	E	P
lambsquarters, common	P	P	F	---	P	P	E	G	E	P	F	E	P	P	E	GE
morningglory spp.	G	P	F	G	G	G	E	E	E	E	GE	GE	P	P	FG	FG
nutsedge, purple	P	P	P	P	PF	P	P	F	P	PF	P	G	P	P	G	P
nutsedge, yellow	P	P	G	P	G	P	P	FG	P	PF	F	FG	P	P	FG	P
panicum, fall	P	E	P	P	P	P	P	E	P	P	P	E	GE	GE	E	P
panicum, Texas	P	E	P	P	P	P	P	E	P	P	P	E	G	GE	E	P
pigweed spp.	G	P	P	G	F	G	E	E	E	P	G	E	P	P	E	GE
ALS-resistant	G	P	P	G	P	G	E	E	E	P	G	E	P	P	E	P
glyphosate-resistant	G	P	P	G	F	G	E	E	E	P	G	E	P	P	P	GE
poinsettia, wild	GE	P	P	---	P	GE	E	G	E	GE	---	GE	P	P	GE	---
purslane, common	G	P	F	G	---	E	---	F	P	---	---	G	P	P	F	---
pusley, Florida	G	P	P	---	F	G	P	F	P	G	---	G	P	P	PF	F
ragweed, common	E	P	F	---	G	E	E	E	E	E	GE	E	P	P	GE	F
redweed	G	P	GE	G	F	F	E	GE	G	---	---	G	P	P	G	---
sandbur	P	E	P	P	P	PF	P	E	P	P	P	E	G	GE	E	P
senna, coffee	FG	P	G	---	P	FG	E	E	P	---	---	FG	P	P	GE	G
sesbania, hemp	G	P	P	G	E	G	E	G	FG	PF	E	E	P	P	PF	F
sicklepod	P	P	P	G	G	P	E	G	FG	F	P	E	P	P	E	P
sida, prickly	G	P	G	---	P	G	E	GE	G	P	F	G	P	P	G	P
signalgrass, broadleaf	P	E	P	P	P	PF	P	E	E	P	P	E	G	E	E	P
smartweed, Pennsylvania	G	E	GE	G	G	GE	E	E	P	---	G	G	P	P	G	GE
spurge	FG	P	F	FG	---	GE	E	GE	E	---	G	G	P	P	G	---
starbur, bristly	GE	P	G	---	G	GE	E	G	E	E	---	E	P	P	GE	P
velvetleaf	G	P	G	---	GE	G	E	E	E	G	F	E	P	P	GE	G
vol. corn	P	G	P	P	P	F	P	E	P	P	F	F	GE	GE	E	P
RR hybrids	P	G	P	P	P	F	P	P	P	P	F	F	GE	GE	P	P
RR/LL hybrids	P	G	P	P	P	F	P	P	P	P	F	F	GE	GE	P	P

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²USE ONLY XTENDIMAX, ENGENIA, and TAVIUM HERBICIDES ON DT SOYBEAN VARIETIES. Use of any other dicamba product on DT soybean is strictly prohibited.

³Use only on Enlist (2,4-D tolerant) soybean varieties.

⁴Use only on glyphosate-tolerant (RR) soybean varieties.

Weed Response to Postemergence Herbicides for Soybean Weed Management (cont.)¹

	Liberty ²	Outlook ³	Poast/ Plus	Prefix	Pursuit	Raptor	Reflex	Resource	Scepter	Select/ MAX	Sequence ⁴	Storm	Ultra Blazer	Warrant ³	Warrant Ultra	Zidua/ SC	2,4-DB
anoda, spurred	P	P	P	P	F	F	P	P	P	P	GE	F	P	P	P	---	P
barnyardgrass	G	GE	GE	F	G	F	F	G	---	GE	E	G	G	GE	F	E	P
beggardweed, Florida	GE	F	P	P	P	---	P	---	P	P	G	P	P	F	P	P	P
Bermudagrass	P	P	FG	P	P	P	P	P	P	G	G	P	P	P	P	P	P
citronmelon	G	P	P	---	P	P	P	---	---	P	G	G	F	P	---	P	P
cocklebur, common	E	P	P	G	E	E	G	G	E	P	E	GE	G	P	G	P	GE
cowpea	G	P	P	F	P	P	F	G	P	P	FG	P	F	P	F	P	P
crabgrass	FG	E	GE	P	PF	FG	P	P	P	GE	E	P	P	E	P	E	P
crotalaria, showy	G	P	P	GE	P	P	GE	---	---	P	G	E	E	P	GE	P	---
croton, tropic	G	P	P	G	P	P	G	P	P	P	GE	GE	G	P	G	---	P
crowfootgrass	G	E	FG	P	P	FG	P	P	P	G	E	P	P	E	P	E	P
dayflower, Benghal	PF	G	P	---	G	---	---	---	---	P	F	F	P	G	---	GE	P
eclipta	G	P	P	G	---	---	G	GE	---	P	G	G	GE	P	G	---	---
goosegrass	P	E	G	P	P	FG	P	P	P	G	E	P	P	E	P	GE	P
jimsonweed	G	P	P	E	FG	E	E	G	P	P	E	E	E	P	E	GE	G
johnsongrass, seedling	G	F	GE	P	GE	FG	P	P	P	GE	E	P	P	F	P	GE	P
johnsongrass, rhizome	F	P	FG	P	G	P	P	P	P	G	E	P	P	P	P	P	P
lambsquarters, common	E	FG	P	PF	P	G	PF	G	P	P	E	G	G	FG	PF	G	F
morningglory, annual	E	P	P	GE	G	FG	GE	FG	P	P	FG	G	GE	P	GE	P	G
nutsedge, purple	P	P	P	P	G	FG	P	P	P	P	G	P	P	P	P	P	P
nutsedge, yellow	P	F	P	F	FG	FG	F	P	P	P	FG	F	P	F	F	FG	P
panicum, fall	G	G	GE	P	F	FG	P	P	P	E	E	P	F	G	P	GE	P
panicum, Texas	G	FG	GE	P	PF	F	P	P	P	GE	E	P	P	FG	P	FG	P
pigweed spp.	FG	G	P	GE	GE	P	GE	FG	G	P	E	GE	G	G	GE	GE	F
ALS-resistant	FG	G	P	GE	P	P	GE	FG	P	P	E	GE	G	G	GE	GE	F
glyphosate-resistant	FG	G	P	GE	GE	P	GE	FG	G	P	P	GE	G	G	GE	GE	F
poinsettia, wild	GE	G	P	G	PF	---	G	FG	G	P	GE	G	GE	G	G	---	P
purslane, common	G	G	P	---	---	---	---	---	---	P	G	G	E	G	---	---	G
pusley, Florida	P	F	P	GE	P	---	GE	G	G	P	FG	E	E	F	GE	G	P
redweed	G	P	P	---	F	---	---	G	---	P	G	GE	---	P	---	---	P
ragweed, common	E	P	P	GE	P	F	GE	G	F	P	GE	GE	E	P	GE	G	F
sandbur	G	G	G	P	---	FG	P	P	P	G	E	P	P	G	P	GE	P
senna, coffee	GE	P	P	FG	F	F	FG	GE	G	P	GE	G	E	P	FG	---	F
sesbania, hemp	GE	P	P	E	P	---	E	P	P	P	PF	E	E	P	E	---	P
sicklepod	G	P	P	P	P	P	P	P	FG	P	E	P	P	P	P	F	F
sida, prickly	G	P	P	P	PF	G	P	P	PF	P	G	G	P	P	P	G	P
signalgrass, broadleaf	G	P	GE	P	G	FG	P	P	P	GE	E	P	P	P	P	G	P
smartweed, Pennsylvania	GE	P	P	G	F	---	G	G	F	P	G	GE	G	P	G	P	P
spurge	G	---	P	G	G	---	G	---	---	P	G	G	G	---	G	G	F
starbur, bristly	GE	F	P	---	PF	---	---	G	---	P	GE	FG	P	F	---	---	PF
velvetleaf	E	P	P	P	PF	E	P	E	P	P	GE	FG	PF	P	P	P	P
vol. corn	F	P	E	F	G	P	F	G	P	GE	E	F	F	P	F	P	P
RR hybrids	F	P	E	F	G	P	F	G	P	GE	P	F	F	P	F	P	P
RR/LL hybrids	P	P	E	F	G	P	F	G	P	GE	P	F	F	P	F	P	P

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Use only on glufosinate-tolerant (LL) soybean varieties.

³For control of listed weeds, these herbicides must be applied prior to weed emergence or tank mixed with a foliar active herbicide.

⁴Use only on glyphosate-tolerant (RR) soybean varieties.

Postemergence Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>acetochlor</i> Warrant 3.0ME	3 pt	1.125 lb	15	---	12 hours
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Comments: Apply WARRANT over-the-top from emergence until R2 growth stage. Provides residual control of small seeded broadleaves and grasses. Optimum application timing for first broadcast application is V2-V3 leaf stage followed by a second directed application after V5 leaf stage. Do not exceed 4.0 qt/A of WARRANT per season. Tank mix with GLYPHOSATE (use only on ROUNDUP READY varieties) or LIBERTY (use only on LIBERTY LINK varieties) for control of existing weeds. Do not apply WARRANT using a sprayable fluid fertilizer as the carrier because of severe crop injury may occur. Do not apply WARRANT to the following soils within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter.

<i>acetochlor</i> +		1.07 lb +	15	45 days	12 hours
<i>fomesafen</i> Warrant Ultra 3.45ME	48 fl oz	0.24 lb	14		

Comments: Apply WARRANT ULTRA after planting soybeans but before soybeans reach R2 growth stage. Environmental conditions that follow application of WARRANT ULTRA including cold, wet soils or saturated conditions from excessive rain may result in crop injury. Do not apply *acetochlor* within 50ft of any well where depth to ground water is 30 feet or less: sands with less than 3% organic matter; loamy sands with less than 2% organic matter; or sandy loams with less than 1% organic matter. These restrictions do not apply to areas outside of the 50ft distance to the well. Do not graze treated area or feed treated forage to livestock following application of WARRANT ULTRA.

<i>aciflourfen</i> Ultra Blazer 2L	0.5-1.5 pt	0.125-0.375 lb	14	75 days	48 hours
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Comments: Apply to soybeans after the 2nd fully expanded trifoliolate but before weeds exceed 4" tall (small, actively growing weeds are the key to success). Controls *ALS- and glyphosate-resistant Palmer amaranth (less than 4" tall at the 1.5 pt/A rate)*, bristly starbur, annual morningglory, tropic croton, and spurred anoda. For control of annual morningglories, use a sequential application of ULTRA BLAZER of 1 pt/A. Add NIS at 1.0-2.0 pt/100-gal spray solution. Tank mix with GLYPHOSATE for enhanced morningglory and *ALS- and glyphosate-resistant Palmer amaranth* control in RR-soybean. Do not apply to weeds and crop that are under stress. **Rainfast interval = 4 hours.**

<i>bentazon</i> Basagran 4S Basagran 5S	1.5-2.0 pt 1.2-1.6 pt	0.75-1.0 lb	6	12 days	48 hours
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Comments: Soybean is tolerant of BASAGRAN at all growth stages. Controls cocklebur, bristly starbur, annual morningglory, and prickly sida. At the high rate, provides temporary suppression of yellow nutsedge (regrowth is likely). May cause a slight leaf burn or speckling. Treat when broadleaf weeds are small and actively growing (less than 4" tall). Adjust rate according to weed size as noted on label. Add COC at 1-2 pt/A or UAN (28-32%) at 4-8 pt/A or AMS at 2.5 lb/A. Do not apply more than 1.0 lb ai/A of *bentazon* per season. **Rainfast interval = 4 hours.**

<i>bentazon</i> +		0.5 lb +	6	75 days	48 hours
<i>aciflourfen</i> Storm 4EC	1.5 pt	0.25 lb	14		

Comments: Apply to soybeans after the 2nd fully expanded trifoliolate, but before weeds exceed the 4-leaf stage (small, actively growing weeds are the key to success). Controls common cocklebur, bristly starbur, annual morningglory, tropic croton, and spurred anoda. Weak on Palmer amaranth. Add COC at 1.0 qt/A or NIS at 1.0-2.0 pt/100 gal of spray solution. Causes temporary foliar burn on soybean. Equivalent to 1 pt/A of BASAGRAN and 1 pt/A of ULTRA BLAZER. Do not apply more than 1.5 pt/A per application or 3.0 pt/A of STORM per season. Do not apply to weeds and crop that are under stress. **Rainfast interval = 4 hours.**

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i> Aim 2EC	0.5-1.5 fl oz	0.008-0.023 lb	14	3 days	12 hours
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Comments: Apply AIM to soybean from V3 up to the V10 stage. Do not apply AIM from emergence through V2 growth stage. Coverage is essential for optimum performance on weeds. Controls velvetleaf, annual morningglory, and *ALS- and glyphosate-resistant Palmer amaranth (up to 4" tall)*. Coverage is essential for optimum activity. May cause temporary burn, speckling, or necrosis of the soybean leaves. Add 1 qt of NIS per 100 gallons of spray solution. May be tank mixed with GLYPHOSATE for broader spectrum control in Roundup Ready (RR) soybean only. Do not use with diphenylether herbicides (examples include ULTRA BLAZER, REFLEX, COBRA). Do not apply more than 1.5 fl oz/A of AIM per season. Do not apply to foliage that is wet from dew, rain, or irrigation. **Rainfast interval = 6 to 8 hours.**

<i>chloransulam-methyl</i> FirstRate 84WDG	0.3 oz	0.016 lb	2	65 days	12 hours
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Comments: FIRSTRATE may be applied after emergence up to the 50% flowering stage. Application prior to full emergence of the first soybean trifoliate leaf may cause temporary yellowing or chlorosis. Add 1-2 pt NIS plus 2.5 gal UAN or COC at 1.2 gal or MSO at 1.2 plus 2.5 gal UAN per 100 gallon of spray solution. Controls bristly starbur, annual morningglory, common ragweed, and sicklepod. Weak on Palmer amaranth. For best results, spray annual morningglory before runners emerge. Applications made to sicklepod beyond the 1-leaf stage will result in reduced control. A second 0.3 oz/A FIRSTRATE application may be necessary 7-10 days afterward to control sicklepod. FIRSTRATE may be tank mixed with ASSURE II, BASAGRAN, CLASSIC, COBRA, GLYPHOSATE, FLEXSTAR, FUSION, HARMONY GT, PHOENIX, POAST PLUS, PURSUIT, RAPTOR, REFLEX, RELIANCE, RESOURCE, SELECT, SYNCHRONY STS, or ULTRA BLAZER. *Tank mix MOA 2 herbicides with another MOA (postemergence and/or residual) for resistance management.* **Rainfast interval = 2 hours.**

<i>chlorimuron</i> Classic 25DF	0.5-0.75 oz	0.008-0.012 lb	2	60 days	12 hours
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Comments: Apply CLASSIC after 1st trifoliate has fully expanded up to 60 days before crop maturity. Controls sicklepod, bristly starbur, and annual morningglory. CLASSIC is weak on Palmer amaranth. Include NIS at 1 qt/100 gallons or COC at 1 gal/100 gallons spray solution. May be tank mixed with glyphosate for broader spectrum control in RR-soybean (use the lower CLASSIC rate at 0.25-0.33 oz/A). Do not tank mix CLASSIC with organophosphate insecticide or do not apply CLASSIC within 14 days before or after an application of organophosphate insecticide as severe crop injury may occur. Do not tank mix CLASSIC with PYTHON as severe crop injury may occur. *Tank mix MOA 2 herbicides with another MOA (postemergence and/or residual) for resistance management.* **Rainfast interval = 1 hour.**

<i>clethodim</i> Select 2EC Select MAX 0.97EC	6.0-16.0 oz 12.0-32.0 oz	0.091-0.25 lb	1	70 days	12 hours
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Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 8 oz/A (12-14 oz/A SELECT MAX) up to 24" tall. A second 6 oz/A (6-18 oz/A SELECT MAX) treatment may be applied to control regrowth. For bermudagrass, treat 6" runners with 8 oz/A (16 oz/A SELECT MAX), and then apply a second application of 8 oz/A (16 oz/A SELECT MAX) to 6" re-growth. Add COC at 1 qt/A plus AMS at 2.5 lb/A for enhanced johnsongrass and volunteer corn activity. Consult label for tank mix partners. Controls volunteer corn in all types of soybean varieties. **Rainfast interval = 1 hour.**

<i>dimethenamid-p</i> Outlook 6EC	12-18 oz	0.56-0.84 lb	15	---	12 hours
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Comments: Apply OUTLOOK from the first trifoliate leaf stage to the fifth-trifoliate leaf stage. Will not control emerged weeds. Provides residual control of small seeded annual grasses and broadleaves. Consult label for tank mix partners. **Rainfast interval = Not applicable**

Postemergence Broadcast Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>dicamba</i>				7 days	24 hours
Engenia 5.0SL	12.8 fl oz.	0.5 lb ae	4		
Xtendimax 2.9SL	22 fl oz.				
<i>dicamba + s-metolachlor</i>		0.5 lb ae + 1.0 lb	4 15		
Tavium 3.37CS	3.53 pt/A				

Comments: *ENGENIA*, *XTENDIMAX*, and *TAVIUM* are a **RESTRICTED USE PESTICIDES** (for sale and use by certified applicators **ONLY**). **USE ONLY ON DICAMBA TOLERANT SOYBEAN VARIETIES!** No applications of these products are permitted after December 20, 2025. *ENGENIA* and *XTENDIMAX* may be applied over-the-top from emergence until June 30th. *TAVIUM* may applied over the top from emergence until V4 or June 30th, whichever comes first. **Do not apply after June 30th.**

Application/Equipment: For **EVERY** application of these **DICAMBA** products, an approved pH buffering adjuvant must be added to the spray mixture. Refer to www.engeniatankmix.com, www.xtendimaxtankmix.com, or www.taviumtankmix.com for a complete list of approved pH buffering adjuvants, nozzles and pressures, and approved tank mix partners. A maximum of two preemergence (0.5 lb dicamba ae/A per application) and two postemergence applications (0.5 lb dicamba ae/A per application) are allowed per year (2 lb dicamba ae/A maximum per year). Apply these products in a minimum of 15 gallons per acre. Use the nozzle manufacturers recommendation for boom height or 24 inches above target pest or crop height, whichever is smaller. Do not exceed 15 miles per hour ground speed (A slower speed is recommended at the field edges). **Do not aerially apply these products. Do not tank mix ammonium-based adjuvant products (i.e., AMS) with these herbicides.** The entire spray system must be cleaned properly before and after application of these products.

Environmental Conditions: Do not apply these products at wind speeds (measured at the boom height) that are less than 3 mph or greater than 10 mph. Product applications are only permitted from 1 hour after sunrise until 2 hours before sunset. Do not apply these products during temperature inversion. Do not apply if expected rainfall amount may exceed soil field capacity and result in runoff in the next 24 hours. **Rainfast interval = 4 hours (all products)**

Downwind Requirements: Do not spray these products if downwind sensitive areas, crops, or residential areas are adjacent to the spray area. After determining no sensitive areas are present downwind, maintain a 240 ft downwind spray buffer. Non-sensitive crop and areas may be used in the buffer distance calculation when directly adjacent to the treated field edges including roads, paved or gravel surfaces; mowed grassy areas adjacent to field; planted agricultural fields containing non-sensitive crops (see label for complete list); areas of bare ground from recent plowing or grading that are contiguous with the treated field; agricultural fields that have been prepared for planting; and areas covered by the footprint of a building, shade house, silo, feed crib, or other manmade structure with walls and a roof. Wind direction may change during application. If wind direction changes toward an adjacent sensitive area, crop, or residential area, **STOP** the application.

Sensitive Crops, Areas, and Residential Areas: Sensitive areas include bodies of water and nonresidential uncultivated areas that may harbor sensitive plant species. Sensitive crops are food, forage, or other plantings grown for sale, use, or consumption. Sensitive crops may also be present in nonagricultural settings, such as residential areas. Examples include non-DT soybeans; cucumbers and melons (EPA crop group 9), flowers; fruit trees; grapes; ornamentals (greenhouse and shade house grown broadleaf plants); peanuts; peas and beans (EPA crop group 6); peppers, tomatoes, and other fruiting vegetables (EPA crop group 8); potato; sweet potato; and tobacco. Consult a sensitive crop registry for possible sensitive sites near your application location.

Endangered Species: Applicators must follow the measures contained in the Endangered Species Protection Bulletin (www.epa.gov/espp/) or 1-844-447-3813 for the site or field where you are applying these products. Applicators must use the bulletin valid for the month in which they will apply these products.

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>fluazifop-p-butyl</i> Fusilade DX 2EC		0.125-0.188 lb	1	60 days	12 hours
	8-12 fl oz				

Comments: Controls annual and perennial grasses before they exceed 6-8" tall. For rhizome johnsongrass control, apply 12 fl oz/A when it is 8-18" tall. Make a second application (8 fl oz/A) when regrowth is 6-12" tall. For bermudagrass, apply 12 fl oz/A when runners are 4-8" long, and repeat 8 fl oz/A when re-growth reaches 4-8". Add COC at 1 gal/100 gallon or NIS 2 pt/100 gallon of spray solution. Controls volunteer corn in all types of soybean varieties. Do not apply more than 30 fl oz/A of FUSILADE per growing season. Do not apply more than 24 fl oz/A from emergence to V5 growth stage. Do not apply more than 6 fl oz/A from bloom to R1 growth stage. **Rainfast interval = 1 hour.**

<i>fluazifop-p-butyl</i> +		0.125-0.189 lb	1	90 days	24 hours
<i>fenoxaprop-p-ethyl</i> Fusion 2.56EC		+			
	8-12 fl oz	0.035-0.053 lb	1		

Comments: Apply 8 fl oz/A for control of most annual grasses before they exceed 6-8" tall. For rhizome johnsongrass, apply 10-12 fl oz/A for control of johnsongrass 8-18" tall. A second 8 fl oz/A treatment may be applied to control regrowth 6-12" tall. For bermudagrass, treat 4-8" runners with 12 fl oz/A, and then apply a second application of 8 fl oz/A to 4-8" re-growth. Add COC at 1 gal/100 or NIS at 2 pt/100 gallon of spray solution. Controls volunteer corn in all types of soybean varieties. **Rainfast interval = 1 hour.**

<i>fluthiacet-methyl</i> Cadet 0.91EC		0.003-0.004 lb	14	60 days	12 hours
	0.4-0.6 fl oz				

Comments: Apply CADET after the 1st trifoliolate through full flowering growth stage. Controls *glyphosate- and ALS-resistant Palmer amaranth (less than 2 inches tall)*, annual morningglory, sicklepod. Apply in a minimum of 15 gallons per acre spray volume. Do not apply more than 1.25 fl oz/A per cropping season. Do not apply through the air. Do not let CADET sit in the sprayer or shuttle tanks overnight. Do not apply to weeds that are under drought stress. **Rainfast interval = 4 hours.**

<i>fomesafen</i> Flexstar 1.88SC Reflex 2EC		0.24-0.35 lb	14	45 days	24 hours
	1.0-1.5 pt	0.25-0.38 lb			

Comments: Controls annual broadleaf weeds such as cocklebur, *ALS- and glyphosate-resistant Palmer amaranth*, and annual morningglory. Add NIS at 1-2 qt or COC at 0.5-1.0 gallons per 100 gallons of spray solution. Do not apply after soybeans begin blooming. Do not exceed 1.5 pt per acre per season. Avoid applying FLEXSTAR or REFLEX to weeds that are under stress from moisture, temperature, or chemical injury as reduce weed control and/or increased crop response may occur. **Rainfast interval = 1 hour. Tank mix MOA 14 herbicides with another MOA (postemergence and/or residual) for resistance management.**

<i>fomesafen</i> +		0.25-0.37 lb	14	45 days	24 hours
<i>glyphosate</i> Flexstar GT 3.29SL Flexstar GT 3.5 2.82SL		+			
	3.0-4.5 pt 3.5-5.3 pt	0.99-1.5 lb ae	9		

Comments: USE ONLY ON GLYPHOSATE TOLERANT SOYBEAN VARIETIES! Controls annual broadleaf weeds such as cocklebur, *ALS- and glyphosate-resistant Palmer amaranth (less than 3 inches tall)*, and annual morningglory. Add AMS at 8.5 lb per 100 gal of spray solution. Do not exceed 4.5 pt/A (FLEXSTAR GT) or 5.3 pt/A (FLEXSTAR GT 3.5) per season. Avoid applying FLEXSTAR GT to weeds that are under stress from moisture, temperature, or chemical injury as reduce weed control and/or increased crop response may occur. **Rainfast interval = 1 hour. Tank mix MOA 14 herbicides with another MOA (postemergence and/or residual) for resistance management.**

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>glufosinate</i>		0.59-0.79 lb	10	70 days	12 hours
Liberty 280SL 2.34S	32-43 fl oz				
Interline 2.34SL					

Comments: USE ONLY ON GLUFOSINATE-TOLERANT SOYBEAN VARIETIES! Spray coverage, warm temperatures, high humidity, and bright sunlight are essential for maximum LIBERTY performance. Controls annual grasses, broadleaf weeds, and *ALS- and glyphosate-resistant Palmer amaranth (less than 4" tall)*. If environmental conditions prevent timely herbicide application, a single application up to 43 fl oz/A from emergence up to but not including bloom growth stage may be made followed by one additional application at a maximum of 32 to 44 fl oz/A with a season maximum of 87 fl oz. Consult label regarding tank mix partners. Add AMS at 3 lb/A to the spray solution if weeds are under stress. **Rainfast interval = 4 hours.**

Resistance Management: Tank mix GLUFOSINATE with a residual herbicide(s) at each application. Soil residual herbicides at burndown and at planting will help ensure optimum weed management particularly if environmental conditions delay timely POST sprayer operations. Overlapping residual herbicides are an effective strategy to reduce potential weed resistance.

<i>glyphosate</i> (various)	22-44 fl oz	0.75-1.5 lb ae	9	7 days	4 hours
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Comments: USE ONLY ON GLYPHOSATE-TOLERANT SOYBEAN VARIETIES! Apply from emergence through flowering growth stage (R2 growth stage). Controls annual grasses and broadleaf weeds. *Will not control glyphosate-resistant Palmer amaranth.* Single or sequential applications may be made. Do not exceed 5.96 lb ae/A (5.3 qt/A) for all combined application types over the entire year. Do not exceed 2.25 lb ae/A (64 fl oz/A) for all combined applications from emergence through R2 growth stage. Do not apply GLYPHOSATE to weeds that are drought stressed; apply only to actively growing weeds. Tank mix partners include BASAGRAN, ULTRA BLAZER, COBRA, FIRSTRATE, FLEXSTAR, HARMONY GT XP, PURSUIT, RAPTOR, or REFLEX. **Rainfast interval = heavy rainfall soon after application may wash product off the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Resistance Management: *Glyphosate-and ALS-resistant Palmer amaranth biotypes are common in South Carolina. Apply multiple herbicide modes-of-action at each application (foliar plus residual herbicides) to prevent selection of new resistant biotypes of Palmer amaranth. Overlapping residual herbicides are an effective strategy to reduce weed resistance development.*

<i>glyphosate</i>		0.75 lb ae	9	50 days	24 hours
+		+			
<i>s-metolachlor</i>		0.94 lb	15		
Sequence 5.25L	2.5 pt				

Comments: USE ONLY ON GLYPHOSATE-TOLERANT SOYBEAN VARIETIES! Apply from cracking up through the 3rd trifoliolate. Controls annual grasses and broadleaf weeds. *s-metolachlor* component provides residual grass and small seeded broadleaf weed control. Do not apply if DUAL MAGNUM or other *s-metolachlor* containing herbicide was applied before the SEQUENCE application. Do not exceed 3.5 pt/A in a single application or 3.5 pt/A in a single season. **Rainfast interval = suggest 2 hours minimum.**

<i>imazamox</i>		0.03-0.04 lb	2	None	4 hours
Raptor 1AS	4.0-5.0 fl oz				

Comments: Apply anytime after soybean emergence up to bloom (but before weeds exceed 3 inches). Controls bristly starbur, crabgrass, Texas Panicum, annual morningglory, and *glyphosate-resistant Palmer amaranth (less than 4" tall; will not control ALS-resistant Palmer amaranth)*. Apply the 4 fl oz/A rate when following a soil-applied grass herbicide (i.e., PROWL). The 5 oz/A rate should be used if no preemergence herbicide was applied. Add COC at 1 to 2 gallons/100 gallons of spray solution or a non-ionic surfactant at 1 qt/100 gallons of spray solution is required. Only one application of RAPTOR is permitted during the growing season. Do not apply more than 5 fl oz/A of RAPTOR per growing season. May tank mix with GLYPHOSATE (RR-soybean only), FIRSTRATE, or ULTRA BLAZER. *Tank mix MOA 2 herbicides with another MOA (postemergence and/or residual) for resistance management. Rainfast interval = 1 hour.*

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>imazaquin</i> Scepter 70DG	1.4-2.8 oz	0.063-0.125 lb	2	90 days	12 hours
<p>Comments: Apply anytime after soybean emergence (better results with small soybeans). Controls <i>glyphosate-resistant Palmer amaranth</i> (use higher rate; will not control ALS-resistant biotypes), common cocklebur, and wild poinsettia. A soil active grass herbicide (PROWL, DUAL MAGNUM, or INTRRO) should follow in a separate application for grass control. Tank mix with GLYPHOSATE (RR-soybeans only) to enhance control of sicklepod and annual grass weeds. Add NIS at 1 qt per 100-gallon spray solution. Do not apply to when weeds and soybeans are under stress. Do not apply more than once per year. Tank mix MOA 2 herbicides with another MOA (postemergence and/or residual) for resistance management. Rainfast interval = None.</p>					
<i>imazethapyr</i> Pursuit 2AS	4.0 oz	0.063 lb	2	85 days	4 hours
<p>Comments: Apply anytime after soybean emergence but before weeds exceed 3 inches. Controls bristly starbur, crabgrass, annual morningglory, and <i>glyphosate-resistant Palmer amaranth</i> (less than 3" tall; will not control ALS-resistant <i>Palmer amaranth</i>). Provides some suppression of yellow and purple nutsedge. Early application is essential for optimum weed control. Add NIS at 1.0 qt or COC at 1 gal plus UAN at 1.25-2.5 gal per 100 gal spray solution. Only one application of PURSUIT may be made during the growing season (Preplant, Preplant Incorporated, Preemergence, or Postemergence). Rainfast interval = 1 hour.</p>					
<i>lactofen</i> Cobra 2EC	12.5 oz	0.2 lb	14	45 days	12 hours
<p>Comments: Apply COBRA to soybeans anytime, but before R6 (full seed set). Controls ALS- and <i>glyphosate-resistant Palmer amaranth</i> (less than 4" tall), annual morningglory, Florida pusley, and bristly starbur. May cause temporary leaf burn, bronzing, or speckling. Add 1-2 pt COC per 100 gallons of spray solution plus 2-4 lb/A of AMS. Do not exceed 25 oz/A of COBRA per season. Do not apply COBRA when weeds or the crop is under stress conditions or do not favor active weed growth. Rainfast interval = 2 hours.</p>					
<i>pyraflufen ethyl</i> ET 0.208EC	0.5-0.75 fl oz	0.0008-0.0012 lb	14	70 days	12 hours
<p>Comments: Apply ET from crop emergence up to the V6 growth stage in a minimum of 5 gal per acre by air or 10 gal per acre by ground. Controls ALS- and <i>glyphosate-resistant Palmer amaranth</i> (less than 4" tall) and annual morningglory. Do not apply more than 1.0 fl oz/A per application. Do not make more than 2 applications of ET per cropping cycle. Some transient speckling may occur on the leaves of the crop; this effect is temporary and will not occur on new growth. Rainfast interval = 1 hour.</p>					
<i>pyroxasulfone</i> Zidua 0.85WG Zidua SC 4.17SC	1.0-3.0 oz 2.5-5.0 fl oz	0.053-0.159 lb	15	None	12 hours
<p>Comments: Apply ZIDUA to soybeans from emergence to the third-foliolate leaf stage. For additional residual and/or activity on emerged weeds add OUTLOOK, PROWL H2O, PURSUIT, RAPTOR, and/or GLYPHOSATE (glyphosate tolerant varieties only!). Do not apply more than 2.1 oz/A of ZIDUA per cropping season on coarse textured soils.</p>					
<i>pyroxasulfone</i> +		0.082-0.163 lb +	15	7 days	12 hours
<i>fluthiacet-methyl</i> Anthem 2.15EC	4.0-9.0 fl oz	0.003-0.006 lb	14		
<p>Comments: Apply ANTHEM from planting through the third trifoliolate stage (V3). Under high moisture conditions the crop may experience some temporary crop response. The crop will rapidly outgrow these effects and develop normally with no reduction in yield. On coarse textured soils (with less than 3% organic matter), do not apply more than 6.8 oz/A of ANTHEM per cropping season. On other soil types, do not apply more than 11.4 oz/A of ANTHEM per cropping season. For enhance control of larger weeds, ANTHEM may be tank mixed with CADET, MARVEL, or other appropriate postemergence soybean herbicides.</p>					

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>quizalofop</i> Assure II 0.88E	5-12 fl oz	0.034-0.069 lb	1	80 days	12 hours
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Comments: Apply 7-8 oz/A overtop to control annual grasses up to 6" tall. Apply 5 oz/A to control volunteer RR-corn in RR-soybean. For control of rhizome johnsongrass, apply 5 oz of Assure II when johnsongrass is 10-24" tall and then retreat with 5 oz when regrowth reaches 6-10" tall. For bermudagrass control, apply 10-12 oz/A at 3" tall (up to 6" runners). Add COC at 1 gal/100 gallons or 1 qt/100 gallons of spray mixture. Do not exceed 18 oz/A in a growing season. Do not apply ASSURE II after pod set. **Rainfast interval = 1 hour.**

<i>s-metolachlor</i> Dual Magnum 7.62EC EverpreX 7.62EC	1.0-1.33 pt	0.95-1.27 lb	15	100 days	24 hours
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Comments: Apply DUAL MAGNUM/EVERPREX from emergence up through the 3rd trifoliolate growth stage. Will not control emerged weeds. Provides residual control of small seeded annual grasses and broadleaves. Consult label for tank mix partners.

<i>s-metolachlor</i> +		1.09-1.24 lb	15	90 days	24 hours
<i>fomesafen</i> Prefix 5.29EC	2.0-2.33 pt	0.24-0.28 lb	14		

Comments: Apply PREFIX to soybean from cracking through the third foliate growth stage. Necrotic spotting, bronzing, leaf crinkling or curling of soybean leaves may occur following postemergence applications, but soybeans soon outgrow these effects and develop normally. For enhanced control of emergence weeds in glyphosate-tolerant soybeans, tank mix PREFIX with glyphosate. Tank mix a NIS if PREFIX is applied alone or if GLYPHOSATE product does not contain a built-in adjuvant. Do not use a COC when applying PREFIX as these spray adjuvants may increase soybean injury. PREFIX may be tank mixed with KARATE or ENDIGO ZC insecticides. Do not exceed 2.33 pt/A in a single postemergence application. Do not exceed 3.0 pint per acre of PREFIX per season. Do use PREFIX postemergence if applied preplant, preplant incorporated, or preemergence previously. *Tank mix MOA 14 herbicides with another MOA (postemergence and/or residual) for resistance management.*

<i>sethoxydim</i> Poast 1.5E Poast Plus 1E	1.0-1.5 pt 1.5-2.25 pt	0.19-0.28 lb	1	75 days	12 hours
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Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 1.5 pt/A (2.25 pt/A POAST PLUS) up to 25" tall. A second 1.0 pt/A (1.5 pt/A POAST PLUS) treatment may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A (2.25 pt/A POAST PLUS), and then apply a second application of 1.0 pt/A (1.5 pt/A POAST PLUS) to 4" re-growth. Add 1 pt/A of DASH HC or SUNDANCE HC adjuvant or COC 2 pt/A. Include UAN at 4-8 pt/A or AMS at 2.5 lb/A for enhanced crabgrass activity. Do not apply more than 2.5 pt/A of POAST per application. Do not apply more than 5.0 pt/A of POAST per season. Do not apply more than 3.75 pt/A of POAST PLUS per application. Do not apply more than 7.5 pt/A of POAST PLUS per season. Consult label for tank mix partners. Controls volunteer corn in all types of soybean varieties. **Rainfast interval = 1 hour.**

<i>thifensulfuron-methyl</i> Harmony GT XP 75DF Harmony SG 50DF	0.083 oz 0.125 oz	0.004 lb	2	45 days	12 hours
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Comments: Apply to soybeans any time after the first trifoliolate has fully expanded. Controls *glyphosate-resistant Palmer amaranth* up to 4" tall (*will not control ALS-resistant Palmer amaranth*). Add NIS at 1-2 pt /100 gallons or COC at 4 pt/100 gallons of spray solution plus a nitrogen fertilizer solution (UAN, 28%) at 2-4 qt/A or AMS at 2-4 lb/A. Do not tank mix HARMONY GT XP with organophosphate insecticide or do not apply HARMONY GT XP within 14 days of an application of organophosphate insecticide as severe crop injury may occur. *HARMONY GT XP rate can be increased up to 0.33 oz/A IF applying OVER-THE-TOP a STS or STS/RR SOYBEAN VARIETY. HARMONY SG rate can be increased up to 0.5 oz/A IF applying OVER-THE-TOP a STS or STS/RR SOYBEAN VARIETY. Tank mix MOA 2 herbicides with another MOA (postemergence and/or residual) for resistance management. Rainfast interval = 3 hours.*

Postemergence Herbicides for Weed Management in Soybean (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
2,4-D choline +		0.70-0.95 lb ae	4	30 days	48 hours
glyphosate Enlist Duo 3.3SL	3.5-4.75 pt	0.73-1.01 lb ae	9		
2,4-D choline Enlist One 3.8SL	1.5-2.0 pt	0.71-0.95 lb ae	4		

Comments: USE ONLY ON 2,4-D TOLERANT SOYBEAN VARIETIES. Apply ENLIST ONE/DUO from emergence but no later than R2 (full flowering stage) when weeds are small and actively growing (Palmer amaranth less than 4 inches). **Before applying ENLIST ONE/DUO, consult with the sensitive crop registry to identify any commercial speciality or certified organic crops that may be planted nearby and conduct a visual survey of the area surrounding the field for the presence of susceptible crops (i.e., tomatoes, fruiting vegetables, cucurbits, grapes, and cotton).** If you can see the susceptible crop and the wind is blowing toward it, **DO NOT SPRAY.** Make one to two postemergence applications with a minimum of 12 days between applications. Water carrier volume should be 10 to 15 gallons per acre for best results. Do not apply at wind speeds are less than 3 mph or greater than 15 mph. Do not apply during a temperature inversion. **A 30 ft downwind buffer (where ENLIST ONE/DUO is not sprayed) is required when wind is blowing toward a sensitive area (i.e., wooded fenceline).** Spray drift potential increases significantly as boom height increases; therefore, position the boom height at the minimum height suggested on the nozzle manufacturer’s directions. **Do not aerielly apply ENLIST ONE/DUO. Do not apply ENLIST ONE/DUO through an irrigation system.** Do not apply more than 4.75 pts per acre in a single application and more than 14.25 pts of ENLIST ONE/DUO per acre combined per season. Do not apply more than 2.0 pts per acre in a single application and more than 6.0 pts of ENLIST ONE per acre combined per season. Do not apply ENLIST ONE if rain is expected within 24 hours of application or irrigate treated fields within 24 hours. Do not apply ENLIST ONE/DUO if rain is expected within 24 hours of application or irrigate treated fields within 24 hours. Do not apply more than two postemergence applications per year. Do not graze treated soybean. Do not harvest soybean for forage or hay. Consult ENLIST ONE/DUO label or www.enlisttankmix.com for the most current approved tank mix partners, required spray nozzles, and stewardship practices. Heavy rainfall soon after application may wash the product from the foliage and require retreatment for weed control. *Thoroughly clean sprayer tank, lines, filters, pumps, strainers, nozzles bodies, and nozzles after applying ENLIST ONE/DUO using the triple rinse method.*

2,4-DB 2S	0.7-0.9 pt	0.18-0.23 lb	4	60 days	48 hours
2,4-DB 1.75S	0.8-1.0 pt				

Comments: Apply 2,4-DB to soybeans approximately 7-10 days before first bloom up to mid-bloom (soybeans are about knee high and actively growing). Broadcast applications outside of this time could result in yield reduction. Controls common cocklebur, annual morningglory, and pigweed (less than 3”). Several tank mix partner options are available, consult label. Do treat soybeans with tank mixes of 2,4-DB and carbaryl (SEVIN) insecticides as severe crop injury may occur. **Rainfast interval = None.**

Postemergence Directed Herbicides for Weed Management in Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>carfentrazone</i> Aim 2EC		0.008-0.023 lb	14	---	12 hours
	0.5-1.5 fl oz				
Comments: Apply AIM as a directed spray toward the base of the plant to avoid contact with the soybean foliage. The use of spray shields will further protect the crop plant from injury. Controls velvetleaf, annual morningglory, and <i>ALS- and glyphosate-resistant Palmer amaranth (up to 4" tall)</i> . Add 1 qt of NIS per 100 gallons of spray solution. Do not feed treated soybean forage or hay to livestock. Do not tank mix and apply AIM herbicide with other diphenylether herbicides (examples include ULTRA BLAZER, REFLEX, COBRA). Do not apply more than 1.5 fl oz/A of AIM per season. Do not apply to foliage that is wet from dew, rain, or irrigation. Rainfast interval = 6 to 8 hours.					
<i>paraquat</i> 2S	1.0-2.0 pt	0.25-0.50 lb	22	15 days	24 hours
<i>paraquat</i> 3S	0.75-1.5 pt				
Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Apply PARAQUAT as a directed spray using a hooded or shielded sprayer to avoid contact with soybean foliage when weeds are small and actively growing. Allow 14 days between applications. For control of 2 to 3 inch sicklepod or pigweed, use the 8 fl oz/A rate. Tank mix 2,4-DB (0.2 lb ai/A) for enhanced control of annual morningglory. Use the higher rate on weeds larger than 6 inches or taller, but they may not be controlled. Do not exceed 11.6 pt/A per season for all uses. Rainfast interval = 30 minutes.					
2,4-DB 2S	0.7-1.6 pt	0.18-0.40 lb	4	60 days	48 hours
2,4-DB 1.75S	0.8-1.8 pt				
Comments: Apply 2,4-DB as a directed spray using drop nozzles where contact only occurs on the bottom third of the soybean plant. Do not allow spray to contact growing terminals of the plant. Do not apply more than 2 applications of 2,4-DB in a growing season. To control annual morningglory up to 3 inches in length, use the 0.7-0.9 pt/A rate of 2,4-DB. For all other broadleaf weeds, apply 2,4-DB at the 1.4-1.6 pt/A rate. Do not treat soybeans with tank mixes of 2,4-DB and carbaryl (SEVIN) insecticides as severe crop injury may occur. Rainfast interval = None.					

Harvest Aids for Soybean

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i> Aim 2EC		0.016-0.032 lb 1.0-2.0 fl oz	14	3 days	12 hours
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Comments: Apply to soybeans after maturity and grain has begun to dry down. Use a minimum of 10 GPA of final spray volume (5 GPA for aerial applications). Desiccates annual morningglory and other harvest impediments. If AIM was applied previously in crop, then it must be counted in the seasonal maximum use rate. Coverage is essential for maximum performance. Add a COC (1-2 gal/100 gals), NIS (1 qt/100 gals), or MSO (1-2 gal/100 gals) to the spray solution. Do not apply to foliage that is wet from dew, rain, or irrigation. **Rainfast interval = 6 to 8 hours.**

<i>glyphosate</i> (various)	**	**	9	**	12 hours
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Comments: Apply to soybeans after pods have set and have lost all green color. Preharvest applications of GLYPHOSATE are not recommended for soybeans grown for seed as a reduction in vigor or germination may occur. **Rainfast interval = heavy rainfall soon after application may wash product off the foliage and a repeat application may be needed to ensure adequate weed control.**

****GLYPHOSATE-TOLERANT-soybeans:** maximum use rate by ground or air for a preharvest application is 22 fl oz/A (0.75 lb ae/A); preharvest interval is 14 days.

****CONVENTIONAL-soybeans:** maximum use rate by ground for preharvest application is 3.3 qt/A (4.8 lb ae/A); applications by air are limited to 44 fl oz/A (1.5 lb ae/A); preharvest interval is 7 days.

<i>paraquat</i> 2S		8.0-16.0 fl oz 0.125-0.25 lb	22	15 days	24 hours
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paraquat 3S 5.4-10.7 fl oz

Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. For indeterminate varieties, apply PARAQUAT when at least 65% of the soybean pods have reached mature brown color or when seed moisture is 30% or less. For determinate soybean varieties, apply PARAQUAT when plants are mature with fully developed pods, ½ of the leaves have dropped, and the remaining leaves are yellowing. Do not apply within 15 days of harvest. For better desiccation of larger weeds, use the higher rate. Add NIS at 1 qt per 100 gal of spray solution. **Rainfast interval = 30 minutes.**

<i>saflufenacil</i> Sharpen 2.85SC		0.022-0.044 lb 1.0-2.0 fl oz	14	3 days	12 hours
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Comments: Apply SHARPEN after soybeans have reached physiological maturity (all pods and seed have no more green color). For indeterminate varieties apply (greater than 65% brown pods and greater than 70% leaf drop) or when seed moisture is 30% or less, and for determinate varieties, apply when beans are fully developed with more than 50% leaf drop, and remaining leaves are yellowing. Apply in a minimum of 10 GPA for ground (5 GPA for aerial) applications. Apply SHARPEN with MSO and ammonium-based adjuvant system. Do not apply to soybean grown for seed production. Do not graze treated fields or feed treated foliage. **Rainfast interval = 1 hour.**

SOYBEAN INSECT CONTROL

Jeremy K. Greene, Research/Extension Entomologist

The keys to managing insect pests in soybean are to:

1. Scout fields during high-risk periods for your area.
2. Correctly identify insect pests.
3. Use treatment thresholds to make spray decisions.
4. Use the safest, most economical, and environmentally sound insecticide and rate.
5. Accurately calibrate spray equipment, and properly apply insecticides.

SCOUTING

Check soybeans regularly from early vegetative stages to beginning maturity (R7). If velvetbean caterpillars (mainly the southern Coastal Plain) or stink bugs are a problem in your area, continue scouting until leaves start to shed (into R7). Place a high priority on checking fields in bloom from the last week of July through August. Corn earworm moths are attracted to blooming fields and will lay more eggs in open-canopied beans on high spots and lighter soil areas. Stink bugs can be difficult to scout for because they may not be found in all areas of a field. Stink bug damage can occur from pod set to when pods begin to yellow, but greatest injury occurs during early pod-fill. Because kudzu bugs are stem feeders, they can infest soybeans during any growth stage and should be scouted for regularly. The most important consideration for any field scouting program is to get a representative sample. If it is impossible to scout all fields, at least sample representative varieties and planting dates each week. Do not treat all fields based on what is found in one variety or maturity group.

Check in at least two different accessible areas of a field, such as opposite ends, or on a lighter and heavier soil type. In both areas move in 20 steps and take at least two samples. Take more samples if insect populations are not clearly above or below the treatment threshold level. To take each sample in conventional wide-row spacing, bend one row out of the way and place a 3 ft by 3 ft beat cloth (also called a ground or drop cloth) with dowel handles between the rows. Bend 3 feet of one row over the cloth and beat down vigorously on the soybeans at least 10 times. Move the beans back, and then count and identify insects. Divide by three to get the number of pests per row foot. Shake the cloth off thoroughly before taking another sample.

Soybeans that are drilled require insect scouting and treatment thresholds tailored for use in narrow rows. There are several sampling alternatives, but the most practical involves using a sweep net. Use a 15-inch diameter heavy-duty sweep net such that the upper edge of the net stays even with or slightly below the top of the canopy as you sweep it through the crop. Sweep forcefully with a back-and-forth motion as you walk through the field. Make one sweep with each stride. You actually make an elongated "figure 8" motion with the net; each pass covering two 38-inch rows or the equivalent width of narrow rows. Make 10 sweeps (each pass in either direction counts as a sweep); then count the number of insects in the net, being careful to sort through the leaves in the bottom of the net. Take a minimum of two 10-sweep samples in each of two different areas of the field, or more until you are confident of your estimates. Note: Sources of sweep nets include Gempler's (www.gemplers.com), Forestry Suppliers (www.forestry-suppliers.com), and SweepNets.com (www.sweepnets.com). Buy the heavy duty 15-inch insect sweep net and order a replacement net.

DEFOLIATION THRESHOLDS

The general defoliation threshold for foliage-feeding pests or pest combinations is 30 percent leaf-area loss before bloom and 15 percent thereafter. There is a tendency to overestimate foliage loss, in part because insects often feed in the upper, more visible part of the canopy. In addition, there is a tendency for the eye to focus more on damaged leaves. A technique to “calibrate” or check defoliation estimates is to remove a trifoliolate leaf (three leaflets) from the top, middle, and lower part of the canopy without looking. Then take an extra leaflet from the middle canopy, for a total of ten leaflets. Look at each leaflet individually, and assign a score of 0 to 10 to each based on an estimate of the portion of leaf area that is missing. For example, a score of 1 requires that at least 10% is missing; a 3 means that 30% is eaten; a 10 indicates that all or nearly the entire leaflet is gone. Add up the score total for all ten leaflets to arrive at a defoliation estimate. Calculate several such defoliation scores and compare the average to estimates made by simply scanning the canopy.

BEAT-CLOTH THRESHOLDS

The thresholds in **Table 1 (per row ft)** and **Table 2 (per 3-ft sample)** can be used with the beat cloth method.

Table 1. Treatment thresholds (per row ft) for soybean insects sampled with beat cloth.					
Pest	Row width (inches)				
	38	30	21	14	7
stink bug	1	0.8	0.5	0.3	0.2
corn earworm*	2	1.6	1.1	0.7	0.4
velvetbean caterpillar	4-6	4	2.7	1.8	0.9
soybean looper	6-8	5.5	3.8	2.6	1.3
*this is the pod-feeding threshold for corn earworm					

Table 2. Treatment thresholds (per 3 row ft) for soybean insects sampled with beat cloth.					
Pest	Row width (inches)				
	38	30	21	14	7
stink bug	3	2.4	1.6	1.1	0.5
corn earworm*	6	4.7	3.3	2.2	1.1
velvetbean caterpillar	12-18	12	8.3	5.5	2.7
soybean looper	18-24	16	11.6	7.7	3.8
*this is the pod-feeding threshold for corn earworm					

SWEEP-NET THRESHOLDS

Sweep net thresholds in drilled soybeans are not as well-defined as those for beat/shake samples. The following thresholds should be considered guidelines until more research is available. Use percent defoliation estimates as an

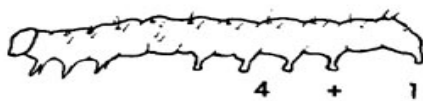
additional treatment guideline for foliage feeders. Prior to bloom, up to 30% defoliation is acceptable without economic yield loss, but once blooming begins, the guideline drops to 15% defoliation.

Table 3. Treatment guidelines for soybean insects sampled with a sweep net.		
Pest	Number per 10 sweeps	Comments
stink bug	1-2	
corn earworm	3	or 15% foliage loss
velvetbean caterpillar	10	or 15% foliage loss
soybean looper	15	or 15% foliage loss
kudzu bug	10 (nymphs)	1 nymph per sweep
For other foliage feeders use a threshold of 30% defoliation before first bloom, 15% after first bloom.		

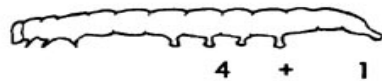
INSECT IDENTIFICATION

The four most common caterpillars found in soybean are the corn earworm, green cloverworm, velvetbean caterpillar, and soybean looper. Because color and size are quite variable, the field key below can be helpful in pointing out distinguishing characteristics.

FIELD KEY TO COMMON SOYBEAN CATERpillARS



CORN EARWORM
 4 + 1 pair prolegs
 Curls up in hand
 Black "warts" on body



VELVETBEAN CATERPILLAR
 4 + 1 pair prolegs
 Very active when handled



SOYBEAN LOOPER
 2 + 1 pair prolegs
 Fatter at tail end
 Looping movement



GREEN CLOVERWORM
 3 + 1 pair prolegs
 Not fatter at tail end
 Looping movement

Corn Earworm (Podworm). Corn earworms have many color variations, but the presence of dark “warts” and more body “hairs” helps to distinguish smaller larvae from other common soybean leps. Corn earworm also tends to curl up in a C-shape when handled. They have a 4 + 1 proleg pattern, unlike green cloverworms or loopers. The primary infestation period is from the last week of July to early September. Corn earworm, often called “podworm,” is a pest throughout the state feeding on foliage, blooms, pods, and terminal stems. Corn earworms and stink bugs are the most economically important pests of soybean because they feed directly on pods.

Velvetbean Caterpillar. 4 + 1 pair prolegs (3 + 1 when small); very active when touched; light green to black; causes problems around mid-August to late October; mainly found in southern Coastal Plain, especially Beaufort, Charleston, Colleton, Hampton and Jasper counties. This late-season pest is often mistakenly called “armyworm” because it seems to appear overnight in large numbers and can rapidly strip a field. The dark color of some specimens also causes confusion. If you see large numbers of very small green worms on the shake cloth late in the season, be on the alert for velvetbean caterpillar defoliation beginning in the top of the canopy.

Soybean Looper. 2 + 1 pair prolegs; looping movement; fatter at “tail-end” of body; usually causes problems from mid-August to mid-September, mainly in cotton production areas and southern coastal counties. The three pairs of thoracic (front) legs may be green or black. Leg color can change on the same insect as it ages and has no effect on insecticide tolerance. This pest prefers plants which are not drought-stressed. Damage usually starts in the middle of a lush canopy.

Green Cloverworm. 3 + 1 pair prolegs; looping movement; not fatter at tail-end; can be problem during July to September; seldom does significant damage by itself, statewide distribution. This insect is often misidentified as looper due to the looping motion of small larvae. This mistaken identity can be expensive. High rates of pyrethroids and other insecticides are often wasted on cloverworms misidentified as loopers.

Stink Bugs. Green or brown shield-shaped insects as adults, immatures with same general shape, but no wings; mainly an August-September problem; mostly southern Coastal Plain. Stink bug damage is much less obvious than caterpillar damage but usually more costly. Stink bug feeding causes shriveled seed with reduced germination and can cause small pods to abort.

Lesser Cornstalk Borer. Green-blue or purple-banded larvae, up to three-quarters of an inch long; found at soil surface or tunneled into stem; body twitches vigorously when touched; builds a sand tube often found attached to the stem. Can be serious pest during drought stress, particularly on soils with a sandy surface. Burning and disking of wheat stubble prior to planting increases lesser cornstalk borer problems. Reduced tillage reduces lesser cornstalk borer damage. This pest destroys soybean stands by girdling or tunneling into seedlings. The problem is usually misdiagnosed as poor germination or stand loss caused directly by drought stress. The preventative treatment listed under control can protect stands in high-risk situations.

Soybean (*Dectes*) Stem Borer. Pale gray adults with long black and gray banded antennae. Larvae are cream-colored legless grubs that tunnel stems of soybeans and other hosts (ragweed, cocklebur, etc.). Larval stage is injurious to soybean by tunneling mainstems, producing seriously damaged plants and significant yield loss when infestation is early, resulting in lodged or cut plants. Associated with repetitive monoculture soybean, so crop rotation helps tremendously with prevention. Insecticide sprays are ineffective in controlling larvae or adults, and cultural practices involving crop destruction and land preparation (i.e. disking, deep plowing) are primary modes of control.

Kudzu Bugs. Kudzu bug adults grow to about the same size as adult lady beetles. They have a small, almost square-like appearance, measure approximately one-fourth inch long, and have a light brown color with an olive-green hue and dark specks. Kudzu bug eggs have a light tan color and are laid in a slanting position in two-row masses. Each barrel-shaped egg has a row of spines around the operculum (lid or opening for emerging nymphs). When immature insects hatch from the eggs, they have an orange color and remain in close proximity to the egg mass for a short time before dispersing. As nymphs grow, they take on a paler green color and a very “hairy” appearance, particularly in the late immature stages. When large numbers of adults and/or nymphs exist together, the species has a very distinct odor that can be quite strong, often to the point of being useful in detecting their presence before visually confirming it.

Timing of major soybean pest infestations South Carolina

Kudzu Bugs (all season)			
	Corn Earworms		
	Loopers		
		Stink Bugs	
		Velvetbean Caterpillars	
July	August	September	October

CHEMICAL AND RATE SELECTION

See the following section for insecticide recommendations. A rate range is usually given for pest control. Factors that influence the required rate are pest size, pest density, plant size, temperature, and application method. The higher rates generally are needed for combinations of heavy populations, larger insects, dense plant canopy, extreme temperatures (95 degrees F), and aerial application.

Use of broad-spectrum insecticides such as Lannate can result in retreatment for late-season velvetbean caterpillar outbreaks. In areas with annual velvetbean caterpillar problems, growers should consider adding Dimilin to corn earworm, stink bug, or boron treatments to prevent retreatment.

SOYBEAN INSECT CONTROL

CORN EARWORM & GREEN CLOVERWORM* (Pyrethroids/Non-Pyrethroids) BEAN LEAF BEETLE, THREECORNERED ALFALFA HOPPER, & JAPANESE BEETLE (Pyrethroids)

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
<i>beta</i> -cyfluthrin (R) Baythroid XL 1 EC	1.6-2.8 oz	0.013-0.022	45.7-80	12 hr	45 d	Pyrethroids provide residual activity for VBC.
<i>lambda</i> -cyhalothrin (R) Warrior II 2.08 CS Silencer 1 EC or Lambda-Cy 1 EC	0.96-1.6 oz 1.92-3.2 oz	0.0156-0.026	80-133 40-66.6	24 hr	30 d	
esfenvalerate (R) Asana XL 0.66 EC	5.8-9.6 oz	0.03-0.05	13-22	12 hr	21 d	Defoliation should not exceed 15-20% after mid-bloom or 30% before mid-bloom.
<i>gamma</i> -cyhalothrin (R) Declare 1.25 CS	0.77-1.28 oz	0.0075-0.0125	100-166	24 hr	30 d	
<i>zeta</i> -cypermethrin (R) Mustang Max 0.8 EC	2.8-4.0 oz	0.0175-0.025	32-45.7	12 hr	21 d	Consider size of population, canopy density, temperature in selecting rate.
<i>zeta</i> -cypermethrin (R) + bifenthrin (R) Hero 1.24 EC	4.0-10.3 oz	0.039-0.01	12.4-32	12 hr	21 d	
bifenthrin (R) Discipline 2 EC or Brigade 2 EC or Fanfare 2 EC	2.6-6.4 oz	0.04-0.1	20-50	12 hr	18 d	After pods appear, treat for 2 or more large (>0.5 in) CEW per row ft.
<i>alpha</i> -cypermethrin (R) Fastac 0.83 CS or EC	3.2-3.8 oz	0.021-0.0246	33.7-40	12 hr	21 d	
Product (non-pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	
indoxacarb Steward 1.25 EC	5.6-11.3 oz	0.054-0.11	11.3-22.8	12 hr	21 d	*Use low rates for GCW that infrequently require control.
spinosad Blackhawk 36 WG	1.7-2.2 oz	0.038-0.05	-	4 hr	28 d	
methomyl (R) Lannate 2.4 LV	0.75-1.5 pt	0.225-0.45	5.3-10.7	48 hr	14 d	Treat for TCAH when stand is threatened, at 3 per row ft, or more than several/sweep.
carbaryl Sevin 80 S Sevin XLR Plus Sevin 4 F	0.94-1.56 lb 0.75-1.25 qt 0.75-1.25 qt	0.75-1.25	- 3.2-5.33 3.2-5.33	12 hr	21 d	
chlorantraniliprole Prevathon 0.43 SC Vantacor 5 SC	14.0-20.0 oz 1.2-2.5 oz	0.047-0.098	6.4-9.1 51.2-106	4 hr	1 d	3-d interval/ application
emamectin benzoate (R) Denim 0.16 EC	8.0-12.0 oz	0.01-0.015	10.7-16	48 hr	28 d	7-d interval/ application
methoxyfenozide/spinetoram Intrepid Edge 3	4.0-6.4 oz	0.094-0.15	20-32	4 hr	28 d	Pre-mixed

THRIPS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
acephate Orthene/Acephate 97 Orthene/Acephate 90	4.6-8.0 oz 5.0-8.96 oz	0.28-0.5	- -	24 hr	14 d	Treat only when stand is threatened

GRASSHOPPERS

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments	
<i>beta</i> -cyfluthrin (R) Baythroid XL 1 EC	2.0-2.8 oz	0.016-0.022	45.7-64	12 hr	45 d	Grasshoppers can be a problem on soybeans in reduced tillage systems. Eggs are deposited in the soil in pods and are not destroyed in minimum tillage. Re-infestation occurs from field edges and from eggs hatching in fields. High rates of acephate or a pyrethroid are needed on larger species. Dimilin, an insect growth regulator (IGR), works only on immatures and should be considered in minimum-tillage fields with a history of problems.	
<i>lambda</i> -cyhalothrin (R) Warrior II 2.08 CS Silencer 1 EC or Lambda-Cy 1 EC	1.6-1.92 oz 3.2-3.84 oz	0.026-0.03	66.6-80 33.3-40	24 hr	30 d		
esfenvalerate (R) Asana XL 0.66 EC	5.8-9.6 oz	0.03-0.05	13-22	12 hr	21 d		
<i>gamma</i> -cyhalothrin (R) Declare 1.25 CS	1.28-1.54 oz	0.0125-0.015	83-100	24 hr	30 d		
<i>zeta</i> -cypermethrin (R) Mustang Max 0.8 EC	3.2-4.0 oz	0.02-0.025	32-40	12 hr	21 d		
bifenthrin (R) Discipline 2 EC or Brigade 2 EC or Fanfare 2 EC	2.6-6.4 oz	0.04-0.1	20-50	12 hr	18 d		
<i>zeta</i> -cypermethrin (R) + bifenthrin (R) Hero 1.24 EC	2.6-6.1 oz	0.025-0.06	21-49.2	12 hr	21 d		
<i>alpha</i> -cypermethrin (R) Fastac 0.83 CS or EC	3.2-3.8 oz	0.021-0.0246	33.7-40	12 hr	21 d		
Product (non-pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI		
acephate Orthene/Acephate 97 Orthene/Acephate 90	4.6-8.0 oz 5.0-8.96 oz	0.28-0.5	- -	24 hr	14 d		
carbaryl Sevin 80 S Sevin XLR Plus or Sevin 4 F	0.94-1.56 lb 0.75-1.25 qt	0.75-1.25	- 3.2-5.33	12 hr	21 d		
diflubenzuron Dimilin 2 L (R)	2.0 oz	0.03125	64	12 hr	21 d	Effective on nymphs only	

SPIDER MITES

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
dimethoate Dimethoate 4 EC	1.0 pt	0.5	8	48 hr	21 d	Can be a problem in drought stress

VELVETBEAN CATERPILLAR

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments	
<i>beta</i> -cyfluthrin (R) Baythroid XL 1 EC	1.6 oz	0.0125	80	12 hr	45 d	VBC occurs in high numbers but is easily controlled. Significant defoliation can be caused by 4-6 large VBC per row ft, and pod clipping can occur after defoliation. Treat when defoliation exceeds 15% after mid-bloom and at 30% before mid-bloom. Pyrethroids can provide extended residual control of VBC. Dimilin (an IGR) is a preventative treatment for high-risk areas.	
<i>lambda</i> -cyhalothrin (R) Warrior II 2.08 CS Silencer 1 EC or Lambda-Cy 1 EC	0.96 oz 1.92 oz	0.0156	133 66.6	24 hr	30 d		
bifenthrin (R) Discipline 2 EC or Brigade 2 EC or Fanfare 2 EC	2.6-6.4 oz	0.04-0.1	20-50	12 hr	18 d		
esfenvalerate (R) Asana XL 0.66 EC	2.9 oz	0.015	44	12 hr	21 d		
<i>gamma</i> -cyhalothrin (R) Declare 1.25 CS	0.77 oz	0.0075	166	24 hr	30 d		
<i>zeta</i> -cypermethrin (R) Mustang Max 0.8 EC	2.8 oz	0.0175	45.7	12 hr	21 d		
<i>zeta</i> -cypermethrin (R) + bifenthrin (R) Hero 1.24 EC	4.0-10.3 oz	0.039-0.01	12.4-32	12 hr	21 d		
<i>alpha</i> -cypermethrin (R) Fastac 0.83 CS or EC	2.8-3.8 oz	0.018-0.0246	33.7-45.7	12 hr	14 d		
Product (non-pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI		
methoxyfenozide Intrepid 2 F	4.0 oz	0.0625	32	4 hr	14 d		
diflubenzuron Dimilin 2 L	2.0-3.0 oz	0.03125-0.047	42.6-64	12 hr	21 d		
spinosad Blackhawk 36 WG	1.1-2.2	0.025-0.05	-	4 hr	28 d		
methomyl (R) Lannate 2.4 LV	4.8-9.6 oz	0.09-0.18	13.3-26.6	48 hr	14 d		
carbaryl Sevin 80 S Sevin XLR Plus or Sevin 4 F	0.5-1.0 lb 1.0-1.5 pt	0.5-0.75	- 5.33-8.0	12 hr	21 d		
chlorantraniliprole Prevathon 0.43 SC Vantacor 5 SC	14.0-20.0 oz 1.2-2.5 oz	0.047-0.098	6.4-9.1 51.2-106	4 hr	1 d	3-d interval/ application	
emamectin benzoate (R) Denim 0.16 EC	8.0-12.0 oz	0.01-0.015	10.7-16	48 hr	28 d	7-d interval/ application	
methoxyfenozide/spinetoram Intrepid Edge 3	4.0-6.4 oz	0.094-0.15	20-32	4 hr	28 d	Pre-mixed	

SOYBEAN LOOPER, TOBACCO BUDWORM, BEET & FALL ARMYWORM

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
indoxacarb Steward 1.25 EC	5.6-11.3 oz	0.054-0.11	11.3-22.8	12 hr	21 d	See CEW defoliation thresholds. It takes 6-8 large loopers per row ft to cause major defoliation. *Not for TBW.
spinosad Blackhawk 36 WG	1.1-2.2	0.025-0.05	-	4 hr	28 d	
methoxyfenozide Intrepid 2 F*	4.0-8.0 oz	0.0625-0.125	16-32	4 hr	14 d	
chlorantraniliprole Prevathon 0.43 SC Vantacor 5 SC	14.0-20.0 oz 1.2-2.5 oz	0.047-0.098	6.4-9.1 51.2-106	4 hr	1 d	3-d interval/ application
emamectin benzoate (R) Denim 0.16 EC	8.0-12.0 oz	0.01-0.015	10.7-16	48 hr	28 d	7-d interval/ application
methoxyfenozide/spinetoram Intrepid Edge 3	4.0-6.4 oz	0.094-0.15	20-32	4 hr	28 d	Pre-mixed

STINK BUGS

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments	
<i>beta</i> -cyfluthrin (R) Baythroid XL 1 EC	1.6-2.8 oz	0.013-0.022	45.7-80	12 hr	45 d	After pods appear, treat when stink bugs reach 1 per row ft using a drop cloth or 1-2 per 10 sweeps using a sweep net. Treat for stink bugs exceeding threshold into R7. Redbanded stink bugs (RBSB) can be more difficult to control. Use mix of pyrethroid and acephate for redbanded stink bug. Orthene might increase chances for problems with SBL or VBC later.	
<i>lambda</i> -cyhalothrin (R) Warrior II 2.08 CS Silencer 1 EC or Lambda-Cy 1 EC	1.6-1.92 oz 3.2-3.84 oz	0.026-0.03	66.6-80 33.3-40	24 hr	30 d		
<i>gamma</i> -cyhalothrin (R) Declare 1.25 CS	1.28-1.54 oz	0.0125-0.015	83-100	24 hr	30 d		
<i>zeta</i> -cypermethrin (R) Mustang Max 0.8 EC	3.2-4.0 oz	0.02-0.025	32-40	12 hr	21 d		
<i>zeta</i> -cypermethrin (R) + bifenthrin (R) Hero 1.24 EC	4.0-10.3 oz	0.039-0.01	12.4-32	12 hr	21 d		
bifenthrin (R) Discipline 2 EC or Brigade 2 EC or Fanfare 2 EC	2.6-6.4 oz	0.04-0.1	20-50	12 hr	18 d		
<i>alpha</i> -cypermethrin (R) Fastac 0.83 CS or EC	3.2-3.8 oz	0.021-0.0246	33.7-40	12 hr	21 d		
Product (non-pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI		
acephate Orthene/Acephate 90 Orthene/Acephate 97	9.6-16.0 oz 8.0-16.0 oz	0.5-1.0	- -	24 hr	14 d		

LESSER CORNSTALK BORER

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
chlorantraniliprole Vantacor 0.43 SC	1.2-2.5 oz	0.047-0.098	51.2-106.7	4 hr	1 d	Reduced tillage can significantly reduce LCB damage, as can early season irrigation. Rescue control can be erratic.

KUDZU BUGS

Product (pyrethroids)	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
bifenthrin (R) Discipline 2 EC or Brigade 2 EC or Fanfare 2 EC	4.0-6.4 oz	0.0625-0.1	20-32	12 hr	18 d	Apply insecticide at one nymph per sweep. If kudzu bug immatures are easily and repeatedly found on petioles and main stems during visual inspections of the canopy, treatment is likely warranted. Do not bias all sampling to border rows where initial populations build. Border treatment for initial infestations of adults limited to field edges can delay need for whole-field treatment.
lambda-cyhalothrin (R) Warrior II 2.08 CS Silencer 1 EC	1.92 oz 3.84 oz	0.03	66.6 33.3	24 hr	30 d	
gamma-cyhalothrin (R) Declare 1.25 CS	1.54 oz	0.015	83	24 hr	30 d	
zeta-cypermethrin (R) Mustang Max 0.8 EC	4.0 oz	0.025	32	12 hr	21 d	
zeta-cypermethrin (R) + bifenthrin (R) Hero 1.24 EC	4.0-10.3 oz	0.039-0.01	12.4-32	12 hr	21 d	
alpha-cypermethrin (R) Fastac 0.83 CS or EC	3.2-3.8 oz	0.021- 0.0246	33.7-40	12 hr	21 d	
Pre-mixed products containing a pyrethroid listed here and another active ingredient with activity on kudzu bugs (see MULTIPLE PESTS – PRE-MIXED PRODUCTS below)						

MULTIPLE PESTS – PRE-MIXED PRODUCTS

Product	Product/acre	Lb ai/acre	Acre/gal	REI	PHI	Comments
thiamethoxam/lambda-cyhalothrin (R) Endigo 2.06 ZC Endigo 2.7 ZCX	2.5-4.5 oz 3.5-4.5 oz	0.04-0.0738	28.4-51.2 28.4-36.6	24 hr	30 d	Season limit of 9 oz/acre Pre-mixed Pre-mixed
imidacloprid/beta-cyfluthrin (R) Leverage 360	2.8 oz	0.0656	45.7	12 hr	14 d	Pre-mixed
imidacloprid/bifenthrin (R) Brigadier 2 SC	5.1-6.1 oz	0.08-0.095	21-25	12 hr	18 or 45 d	Pre-mixed
chlorantraniliprole/lambda-cyhalothrin (R) Besiege 1.25 ZC	5.0-10.0 oz	0.049-0.098	12.8-25.6	24 hr	30 d	Season limit of 20 oz/acre Pre-mixed
chlorantraniliprole/bifenthrin (R) Elevest 2.22 SC	6.9-9.6 oz	0.12-0.167	13.3-18.5	12 hr	21 d	Pre-mixed
methoxyfenozide/spinetoram Intrepid Edge 3	4.0-6.4 oz	0.094-0.15	20-32	4 hr	28 d	Pre-mixed
alpha-cypermethrin/afidopyropen (R) Renestra 0.64 DC	6.8 oz	0.034	18.8	12 hr	14 d	Pre-mixed

Pre-mixed products	Pests and Activity of Product (does not imply good control...just activity)										
	LCB	VBC	TCAH	BAW/FAW	CEW	TBW	SBL	GCW	SB	KB	Grasshoppers
Leverage	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Endigo	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Brigadier	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Besiege	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Elevest	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Intrepid Edge	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	No	No
Renestra	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes

For control of multiple pests exceeding thresholds, including but not limited to various combinations of the following: cutworm, cabbage looper, green cloverworm (GCW), corn earworm (CEW), saltmarsh caterpillar, aphids, threecornered alfalfa hopper (TCAH), velvetbean caterpillar (VBC), bean leaf beetles, grasshoppers, plant bugs, kudzu bug (KB), and stink bugs (SB). Use higher rates for stink bugs, corn earworm, and grasshoppers.

ai = active ingredient; **(R)** = Restricted use; **REI** = re-entry interval; **PHI** = pre-harvest interval

SOYBEAN DISEASE CONTROL

John D. Mueller, Extension Soybean Pathologist

Soybeans can be affected by diseases throughout the growing season. In general seedling diseases are only a problem in fields planted very early in the growing season when soil temperatures are low. They are especially prevalent if low soil temperatures are combined with very wet soils. Usually by mid-May seedling diseases are no longer a problem.

Seed-treatment fungicides normally do a good job of controlling seedling diseases. During mid-season many leaf diseases are common on soybean. Downy mildew, brown spot (septoria blight), cercospora leaf blight and frogeye leaf spot are very common and stem diseases such as pod & stem blight and anthracnose are common from midseason to harvest in wet years. Soybean rust is active in South Carolina primarily after mid-August in most years. Target spot has become a problem in recent years on soybeans in the Southeastern United States. It will not occur during a drought but can occur in irrigated fields or fields receiving high rainfall, especially after flowering. Target spot overwinters on ground debris from last year's crop. If target spot was present in a field last year, then that field has a higher probability of target spot occurring this year and should be sprayed with a fungicide if target spot appears, especially if an extended period of rain is predicted.

Soybean varieties vary greatly in their susceptibility to diseases such as frogeye leaf spot. Choosing a resistant variety is more cost effective than fungicide applications. Fungicides are available that can help with many of these diseases. It is important to accurately identify the diseases you are trying to control, as not all diseases can be controlled by all fungicides. Check the label of individual fungicides or your South Carolina Soybean Production Guide for information on accurate identification of diseases based on field symptoms.

In general South Carolina soybeans should not be sprayed for disease control until after they flower. This is true whether soybean rust or other diseases are the target. Wet weather increases the severity of most fungal diseases and the subsequent need for a fungicide. Spraying a fungicide in dry weather is often unnecessary. Foliar diseases tend to respond well to fungicide applications. Stem diseases such as charcoal rot are more difficult to control and lower stem diseases such as red crown rot (CBR) and Southern blight (white mold) are almost impossible to control with fungicides. For information on the relative efficacy of fungicides against soybean foliar diseases (especially cercospora leaf blight, frogeye leaf spot and rust) check the North Central Regional Committee on Soybean Diseases (NCERA-137) report.

FUNGICIDES AVAILABLE FOR CONTROLLING SEEDLING DISEASES ON SOYBEAN

Product	Active Ingredient	FRAC Code	Fungi Controlled	Rate
Allegiance FL	metalaxyl 28.35%	4	<i>Pythium</i> spp.	0.75 – 1.5 fl oz/cwt
Apron XL	mefenoxam 33.3%	4	<i>Pythium</i> spp. <i>Phytophthora</i> spp.	0.16 – 0.64 fl oz/cwt
ApronMaxx RFC	mefenoxam 3.46% fludioxonil 2.31%	4 12	<i>Fusarium</i> spp., <i>R. solani</i> , <i>Pythium</i> spp. <i>Phytophthora</i> spp.	1.5 fl oz/cwt
ApronMaxx RTA + Moly	mefenoxam 1.02% fludioxonil 0.68% molybdenum 4.67%	4 12	<i>Fusarium</i> spp. <i>Pythium</i> spp., <i>Phytophthora</i> spp. <i>R. solani</i>	5.0 fl oz/cwt
Bean Guard/ Allegiance	carboxin 12.5% metalaxyl 3.75% captan 24.45% molybdenum 11.9%	7 4 M4	<i>Pythium</i> spp. <i>R. solani</i> <i>Fusarium</i> spp.	2.0 oz/60 lbs
CruiserMaxx Vibrance	thiamethoxam 20.8% Mefenoxam 3.13% Fludioxonil 1.04% sedaxane 1.04%	Insecticide 4 12 7	<i>Fusarium</i> spp., <i>Pythium</i> spp., <i>Phytophthora</i> spp. <i>R. solani</i>	3.22 fl oz/cwt Commercial seed treatment only
Dynasty	azoxystrobin 9.6%	11	<i>Pythium</i> spp., <i>R. solani</i> <i>Sclerotium rolfsii</i>	0.153 – 0.459 fl oz/per cwt
EverGol Energy SB	prothioconazole 7.18% penflufen 3.59% metalaxyl 5.74%	3 7 4	<i>Fusarium</i> spp. <i>Pythium</i> spp. <i>R. solani</i>	1.0 fl oz/cwt Commercial seed treatment only
Evito 480 SC	fluoxastrobin 40.3%	11	<i>R. solani</i> <i>Sclerotium rolfsii</i>	0.16–0.24 fl oz per 1000 ft row
Headline SC	pyraclostrobin 3.3%	11	<i>R. solani</i>	0.1–0.8 fl oz/ 1000 ft of row
Stamina 1.67 FC	pyraclostrobin 18.4%	11	<i>R. solani</i>	0.4 fl. oz/cwt Commercial seed treatment only
ILEVO Seed Treatment	fluopyram 49.02%	7	Sudden Death Syndrome	2.17 - 3.62 fl oz/cwt Commercial seed treatment only
Maxim 4FS	fludioxonil 40.3%	12	<i>Fusarium</i> spp. <i>R. solani</i>	0.08–0.16 fl oz/cwt
Saltro	pydiflumetofen 41.7	7	Sudden Death Syndrome	1.52 fl oz/cwt
Trilex 2000	trifloxystrobin 7.12% metalaxyl 5.69%	11 4	<i>Fusarium</i> spp., <i>Pythium</i> spp. <i>R. solani</i>	1.00 fl oz per cwt
Vayantis 3.3 FC	Picarbutrazox 36%	U17	<i>Pythium</i> spp., <i>Phytophthora</i> spp.	0.039–0.195 fl oz/cwt
Vibrance 4.3 FS	sedaxane 43.7%	7	<i>R. solani</i>	0.075–0.16 fl oz/cwt
Vitavax-34 Seed Treatment	carboxin 34%	7	<i>R. solani</i>	3–4 fl oz/cwt

Do not use treated seed for food, feed or oil purposes. Do not graze or feed livestock on forage or hay grown from treated soybean seed. All treated seed must be colored with an EPA-approved dye which imparts an unnatural color to the seed to help prevent the inadvertent use of treated seed as food for man or feed for animals.

FOLIAR FUNGICIDES FOR USE ON SOYBEAN IN SOUTH CAROLINA¹

Product	Active Ingredient(s) % a.i.	FRAC Code	Rate (fl. oz. /acre)	No. of appl. /year & max. (fl. oz. /acre) /year	Diseases Controlled
Affiance 1.5 SC	azoxystrobin 9.35% tetraconazole 7.48%	11 3	10.0-14.0	3(28.7)	Rust + other diseases
Aftershock	fluoxastrobin 40.3%	11	2.7 - 5.7	2(11.4)	Rust + other diseases
Alto 100 SL	cyproconazole 8.9%	3	2.75-5.5	2(11)	Rust + other diseases
Approach	picoxystrobin 22.5%	11	6.0-12.0	3(36)	Rust + other diseases
Approach Prima	picoxystrobin 17.94% cyproconazole 7.17%	11 3	5.0-6.8	2(13.6)	Rust + other diseases
Cercobin Fungicide	thiophanate-methyl 41.3%	1	10.9-21.8	2(43.6)	For other diseases Will not control rust
Thiophanate Methyl 85 WDG	thiophanate-methyl 85%	1	0.4-0.8 lbs/acre	2(1.6 lbs)	For other diseases Will not control rust
TOPSIN 4.5 FL	thiophanate-methyl 45.0%	1	10.0-20.0	2(40)	For other diseases Will not control rust
Topsin M WSB	thiophanate-methyl 70.0%	1	0.5 - 1.0 lbs/acre	2(2 lbs)	For other diseases Will not control rust
Topsin XTR	thiophanate-methyl 37.5 % tebuconazole 7.5%	1 3	16.0-20.0	3(49.8)	Rust + other diseases
Acropolis 2.38 F	thiophanate-methyl 21.27% tetraconazole 4.20%	1 3	20.0 - 23.0	2(see label)	Rust + other diseases
Froghorn 4.3 SC	thiophanate-methyl 37.5% tebuconazole 7.5%	1 3	20.0	See label	Rust + other diseases
Custodia	azoxystrobin 11.0% tebuconazole 18.35%	11 3	8.6	3(25.9)	Rust + other diseases
Domark 230 ME	Tetraconazole 20.5%	3	4.0 - 5.0	2(10)	Rust + other diseases
Andiamo 230 ME	Tetraconazole 20.5%	3	4.0 - 5.0	2(10)	Rust + other diseases
Endura Fungicide	Boscalid 70.0%	7	3.5 - 5.5	2(22)	For other diseases. Will not control rust
Evito 480 SC	fluoxastrobin 40.3%	11	2.0-5.7	2(11.4)	Rust + other diseases
Evito-T Fungicide	fluoxastrobin 18.0% tebuconazole 25.0%	11 3	4.0-6.0	2(11.4)	Rust + other diseases
Fortix Fungicide	fluoxastrobin 14.84% flutriafol 19.30%	11 3	4.0-6.0	2(12)	Rust + other diseases
Preemptor SC Fungicide	fluoxastrobin 14.84% flutriafol 19.30%	11 3	4.0-6.0	2(12)	Rust + other diseases
tebuconazole 3.6 F (multiple generics)	tebuconazole 38.7%	3	3.0-4.0	3(12)	Rust + powdery mildew
Headline SC Fungicide	pyraclostrobin 23.3%	11	6.0-12.0	2(24)	Rust + other diseases

FOLIAR FUNGICIDES FOR USE ON SOYBEAN IN SOUTH CAROLINA¹(Cont.)

Product	Active Ingredient	FRAC Code	Rate (fl oz /acre)	No. of appl. /year & (max. fl oz /acre) /year	Disease Controlled
Priaxor 4.17 SC	fluxapyroxad 14.33% pyraclostrobin 28.58%	7 11	4.0-8.0	2(16)	Rust + other diseases
Proline 480 SC	prothioconazole 41.0%	3	2.5-3.0	3(9)	Rust + Powdery mildew
Delaro Complete	prothioconazole 14.9% trifloxystrobin 13.1% fluopyram 10.9%	3 11 7	8.0-11.0	3(33)	Rust + other diseases
Miravis Top	pydiflumetofen 6.9% difenoconazole 11.5%	7 3	13.7	2(27.5)	Cercospora leaf spot, frog-eye, pod & stem blight, target spot
Quadris Flowable multiple generics	azoxystrobin 22.9%	11	6.0-15.5	2(92)	Rust + other diseases
Quadris Top SB	azoxystrobin 18.2% difenoconazole 11.4%	11 3	8.0- 14.0	2(26.5)	Rust + other diseases
Quadris Top SBX	azoxystrobin 19.8% difenoconazole 19.8%	11 3	7.0- 0.5	2(14.8)	Rust + other diseases
Helmstar Plus SC	azoxystrobin 11.0% tebuconazole 22.0%	11 3	7.2	3(21.8)	Rust + other diseases
Brixen Fungicide	azoxystrobin 13.76% tetraconazole 6.67%	11 3	13.0-16.0	2(32)	Rust + other diseases
Quilt Fungicide	azoxystrobin 7.0% propiconazole 11.7%	11 3	14.0-20.5	2(42)	Rust + other diseases
Cover XL	azoxystrobin 13.5% propiconazole 11.7%	11 3	10.5-21.0	2(42)	Rust + other diseases
Quilt Xcel	azoxystrobin 13.5% propiconazole 11.7%	11 3	10.5-21.0	2(42)	Rust + other diseases
Revytek	mefentrifluconazole 11.61% fluxapyroxad 7.74% pyraclostrobin 15.49%	3 7 11	8.5 to 15.0	2(30)	Rust + other diseases
Stratego	propiconazole 11.4% trifloxystrobin 11.4%	3 11	10.0	3(30)	Rust + some other diseases
Stratego YLD	prothioconazole 10.8 trifloxystrobin 32.3%	3 11	4.0-4.65	3(13.95)	Rust + other diseases
Tilt Bumper	propiconazole 41.8%	3	4.0-6.0	2(12)	Rust + other diseases
Topguard FUNGICIDE	flutriafol 11.8%	3	7.0-14.0	2(14)	Rust + other diseases
Topguard EQ	Flutriafol 18.63% Azoxystrobin 25.3%	3 + 11	5.0-8.0	3(15.5)	Rust + other diseases
Lucento	flutriafol 26.47 % bixafen 15.55 %	3 7	3.0- 5.5	2(11)	Rust + other diseases
Trivapro Fungicide	benzovindiflupyr 10.27% azoxystrobin 13.5% propiconazole 1.7%	7 11 3	20.7	2(41.4)	Rust + other diseases
Veltmya	Mefentrifluconazole 17.56% Pyraclostrobin 17.56%	3 11	7.0 to 10.0	2(20)	Rust + other diseases
Vertisan	Penthiopyrad 20.6%	7	10.0-30.0	2(61)	Rust + other diseases
Zolera FX Fungicide	fluoxastrobin 17.76% tetraconazole 17.76%	11 3	4.4-6.8	1(6.8)	Rust + other diseases

¹For a list of specific diseases controlled by each fungicide please see a product label.

PRODUCTS CONTAINING CHLOROTHALONIL FOR THE CONTROL OF RUST AND OTHER FOLIAR DISEASES OF SOYBEAN¹

Product	Active Ingredient TwinLine Fungicide	FRAC Code	Rate per acre	Maximum total/year
Bravo Weather Stik	chlorothalonil 54.0%	M5	1.5-2.25 pts (2 appl.) 1.0-2.0 (3 appl.)	6.0 pts
Bravo Ultrex	chlorothalonil 82.5%	M5	0.9 -1.4 lbs (3 appl.) 1.4 – 2.2 lbs (2 appl.)	5.4 lbs
Echo 720	chlorothalonil 54%	M5	16 – 32 fl oz (3 appl.) 24 – 40 fl oz (2 appl.)	96.0 fl oz
Echo 90DF	chlorothalonil 90%	M5	0.875–1.62 lbs (3 appl.) 1.25–2.0 lbs(2 appl.)	4.4 lbs
Equus 720 SST	chlorothalonil 54.0%	M5	1.0–2.0 pts (3 appl.) 1.5–2.25 pts (2 appl.)	6.0 pts
Equus DF	chlorothalonil 82.5%	M5	0.9–1.4 lbs (3 appl.) 1.4–2.1 lbs (2 appl.)	5.4 lbs
Arius ADV	chlorothalonil 44.0% azoxystrobin 11.6%	M5 11	20.0–25.0 fl. oz. (2 appl.)	See label
Mazinga ADV	chlorothalonil 27.69% tetraconazole 2.09%	M5 3	2.0 pts (2 appl.)	See label

¹For a list of specific diseases controlled by each fungicide please see a product label.

SOYBEAN NEMATODE CONTROL

John D. Mueller, Extension Soybean Pathologist

Nematode-induced yield losses in South Carolina soybeans are caused primarily by Southern root-knot, soybean cyst, Columbia lance, and reniform nematodes. Soybean is an excellent host for these nematode species and often sustains significant yield losses. Sting, lesion, and peanut root-knot nematodes also cause yield losses in some fields. Use of nematicides for controlling nematodes on soybeans is often cost prohibitive. Use of a nematicide should be coupled where possible with the use of resistant varieties and in-row subsoiling or deep tillage. In many instances nematode control may require rotation to a non-host crop. Please see your South Carolina Soybean Production Guide for more in-depth information on nematode management.

NEMATICIDES AVAILABLE FOR CONTROLLING SOYBEAN NEMATODES. SEE LABELS FOR SPECIES CONTROLLED BY EACH PRODUCT.

Nematicide	Active ingredient	Rate per acre for 38-inch rows	Comments
Telone II	1,3-dichloropropene	3.0 – 6.0 gallons	Release fumigant at least 12 inches from the soil surface. Must be applied 10–14 days prior to planting.
AgLogic 15G & AgLogic 15GG	aldicarb	6.0 lbs.	Apply a 4- to 6-inch T-band over open seed furrow and immediately cover with soil.
Avicta Complete Beans 500	Abamectin, thiamethoxam Mefenoxam, fludioxonil	6.2 fl oz per cwt of seed	Application by commercial seed treaters only.
AVICTA 500 FS	abamectin	See Label	Applied only as a commercial seed treatment. Controls only nematodes.
Bio ST Nematicide 100	Heat killed <i>Burkholderia</i> spp. strain A396 + spent fermentation media	8.0 oz per cwt of seed	Can be applied as commercial seed treatment or as a seed dressing at plant.
Clariva pn	<i>Pasteuria nishizawae</i> – Pn1	1.0 to 3.0 fl oz per cwt of seed	Effective only against Soybean cyst nematode.
Clariva Elite Beans	<i>P. nishizawae</i> – PN1 thiamethoxam, sedaxane mefenoxam, fludioxonil	5.6 fl oz per cwt of seed	Includes the nematicide Clariva pn, the only nematode this will control is Soybean cyst nematode.
ILeVO 600 FS	fluopyram	1.08 to 3.62 fl oz per cwt of seed	Apply using commercial slurry or mist-type seed treatment equipment.
Poncho Votivo Seed Treatment	clothianidin <i>Bacillus firmus</i> I-1582	1.02 fl oz per 140,000 seed	Applied only as a commercial seed treatment. Can control nematodes and thrips.
PONCHO/VOTiVO	clothianidin <i>Bacillus firmus</i> I-1582	2.4 fl oz per 100,000 seed	Apply only as a commercial seed treatment. Can control nematodes and thrips.
Saltro	pydiflumetofen	1.52 fl. oz Per cwt seed	For control of Sudden Death Syndrome and plant-parasitic nematodes.
Trunemco corn/soy	<i>Bacillus amyloliquefaciens</i> strain MBI 600 + cis-Jasmone	0.15 – 0.31 fl oz Per cwt of seed	Only for use in commercial seed treatment facilities
Aveo EZ Nematicide	<i>Bacillus amyloliquefaciens</i> strain PTA 4838	0.1 fl oz per 140,000 seed	For reniform, root-knot and soybean cyst nematodes. Must be applied utilizing commercial liquid, slurry or mist-type seed treating equipment.
Acceleron Nemastrike ST	tioxazafen	2.2-4.4 fl oz per 140,000 seed	Apply only in commercial seed treatment facilities using fully automated closed transfer and application equipment.

WEED CONTROL IN SUNFLOWER

Mike Marshall, Extension Weed Specialist

Preplant/Burndown Herbicides for Weed Management in Sunflower

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>carfentrazone</i> Aim 2EC	1.0-2.0 oz	0.016-0.032 lb	14	3 days	12 hours
Comments: Apply anytime before planting when weeds are small. Use a higher rate for larger weeds. Add a COC (1-2 gal per 100 gals spray solution, NIS (1 qt per 100 gals spray solution), or MSO (1-2 gal per 100 gals of spray solution). Tank mix partners include GLYPHOSATE, LIBERTY, PARAQUAT.					
<i>carfentrazone</i> +		0.016-0.028 lb	14	None	12 hours
<i>sulfentrazone</i> Spartan Charge 3.5F	3.75-7.75 fl oz	+ 0.16-0.25 lb	14		
Comments: Apply SPARTAN CHARGE prior to 1-2 weeks prior to planting or up to 3 days after planting sunflowers. For an increased weed spectrum, tank mix with GLYPHOSATE, LIBERTY, or PARAQUAT. Add SPARTAN CHARGE to the spray tank first.					
<i>paraquat</i> 2S	2.5-4.0 pt	0.63-1.0 lb	22	None	12 hours
<i>paraquat</i> 3S	1.7-2.7 pt				
Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Apply PARAQUAT prior to planting to effectively desiccate weeds for more efficient planting and reduce competition with sunflower seedlings. Add non-ionic surfactant at 2 qt/100 gallons of spray solution. Do not make more than 3 applications per year (preplant/preemergence).					
<i>glufosinate</i> Liberty 280 2.34SL Interline 2.34SL	29-36 oz	0.53-0.66 lb	10	70 days	12 hours
Comments: Spray coverage is essential for optimum performance. Ground application requires a minimum of 15 gallons of water/acre. Dense weed canopies require 20 to 40 gallons per acre. See label for further application instructions and tank-mix partners.					
<i>glyphosate</i> (various)	22-32	0.75-1.13 lb ae	9	None	4 hours
Comments: Apply 1-2 weeks prior to planting date to control existing grass and broadleaf weeds and to reduce competition with sunflower seedlings.					

Weed and Cover Crop Response to Burndown/Preplant Herbicides in Sunflower¹

	Aim ²	Glyphosate ²	Paraquat ²	Liberty ²
barley, little	F	E	G	G
bluegrass, annual	G	F	G	P
buttercups	G	E	E	E
chickweed, common	G	F	E	E
clovers	P	PF	G	F
cudweed	G	E	FG	G
dandelion	P	P	N	FG
dock, curly	P	PF	F	G
eveningprimrose, cutleaf	GE	PF	F	G
geranium, Carolina	GE	FG	GE	GE
henbit/deadnettle	G	F	G	G
horseweed (maretail)	G	E	F	GE
mustard, wild	G	FG	FG	GE
pansy, field	G	F	G	G
pepperweed, Virginia	G	G	G	G
radish, wild	G	FG	G	GE
ryegrass, Italian	F	G	FG	P
sorrel, red	F	E	E	PF
spurry, corn	G	GE	FG	---
swinecress	G	FG	PF	GE
vetch	GE	F	G	GE
wheat/rye cover crop	P	E	FG	F

¹**Key to Response Ratings:** E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control 70 to 80%; P = poor control, less than 70%; --- = Insufficient Data.

²Herbicide rates for burndown are: Aim at 1.0 oz/A; Glyphosate at 0.75 lb ae/A (22 oz/A of 4.5 lb ae/gal or 32 oz/A of 3.0 lb ae/gal); Paraquat at 3.0 pt/A; and Liberty at 29 oz/A.

Preplant Incorporated (PPI) Herbicides for Weed Management in Sunflower

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>ethalfuralin</i> Sonalan HFP 3EC	1.5-2.0 pt	0.6-0.75 lb	3	None	24 hours
Comments: Controls annual grasses and small seeded broadleaf weeds. Incorporate into the top 2 inches of soil within 48 hours of application.					
<i>pendimethalin</i> Prowl H2O 3.8EC Prowl 3.3EC	1.5 pt 1.7 pt	0.71 lb	3	21 days	24 hours
Comments: Control of annual grasses and small seeded broadleaf weeds. Incorporate into the top 2 inches of soil within 7 days of application. Can also be applied preemergence (after planting, prior to crop emergence).					
<i>s-metolachlor</i> Dual Magnum 7.62SC	1.0-1.33 pt	0.96-1.27 lb	15	None	24 hours
Comments: Control of annual grasses and small seeded broadleaf weeds. Incorporate into the top 2 inches of soil. Can also be applied preemergence surface application (after planting, prior to crop emergence). Provides early season yellow and purple nutsedge suppression.					

Preplant Incorporated (PPI) Herbicides for Weed Management in Sunflower (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>pyroxasulfone</i> + <i>sulfentrazone</i> Authority Edge 4.25SC		0.052-0.078 lb + 0.094-0.141 lb 4.4-6.6 fl oz	14	None	12 hours
Comments: Apply AUTHORITY EDGE and shallowly incorporate up to 2 inches. AUTHORITY EDGE can cause sunflower injury at high rates on light soil. Do not apply more than 11.71 fl oz/A of AUTHORITY EDGE in a single application. Do not make more than 2 applications of AUTHORITY EDGE per season.					
<i>sulfentrazone</i> Spartan 4F		0.094-0.188 lb 3.0-6.0 fl oz	14	None	12 hours
Comments: Apply SPARTAN and shallowly incorporate up to 2 inches (Do not incorporate more than 2 inches). SPARTAN can cause sunflower injury at high rates on light soil. SPARTAN can also be applied preemergence (at planting or up to 3 days after planting, but prior to crop emergence). Apply SPARTAN a minimum of 7-14 days before planting on coarse textured soils. Do not apply to soils classified as SANDS with less than 1.0% organic matter. Do not apply more than 8.0 fl oz/A of SPARTAN per growing season.					
<i>trifluralin</i> Treflan 4EC		0.5-0.75 lb 1.0-1.5 pt	3	60 days	12 hours
Comments: Controls annual grasses and small seeded broadleaf weeds. Incorporate into the top 2 inches of soil within 48 hours of application.					

Preemergence (PRE) Herbicides for Weed Management in Sunflower

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>carfentrazone</i> + <i>sulfentrazone</i> Spartan Charge 3.5F		0.016-0.028 lb + 0.16-0.25 lb 3.75-7.75 fl oz	14	None	12 hours
Comments: Apply SPARTAN CHARGE as a broadcast surface application at planting or up to 3 days after planting. Plant sunflowers at least 1.0 inch deep. Tank mix with a grass herbicide for broader spectrum control. Do not apply SPARTAN CHARGE after crop emergence. Do not apply more than 10.2 fl oz SPARTAN CHARGE in a 12-month period. Do not use on soils classified as sands, which have less than 1% organic matter.					
<i>pendimethalin</i> Prowl H2O 3.8EC Prowl 3.3 EC		0.71 lb 1.5 pt 1.7 pt	3	21 days	24 hours
Comments: Apply PROWL at or up to 2 days after planting. Controls annual grasses and small seeded broadleaf weeds. Plant sunflower seed 1.5-2.0 inches deep and ensure soil covers the furrow completely. Preemergence applications of pendimethalin may increase the likelihood of injury if crops are grown in stressful situations.					
<i>pyroxysulfone</i> Zidua SC 4.17SC		0.057-0.163 lb 1.75-5.0 fl oz	15	60 days	12 hours
Comments: Apply ZIDUA SC as a broadcast spray to the soil surface after planting and before crop emergence. Ensure seedbed is free of clods, trash, and cracks such that row closure is uniform behind the press wheel and the seed is properly covered. Do not apply more than 2.5 fl oz/A of ZIDUA SC on coarse textured soils per cropping season.					
<i>s-metolachlor</i> Dual Magnum 7.62SC		0.96-1.27 lb 1.0-1.33 pt	15	None	24 hours
Comments: Apply DUAL MAGNUM after planting but before crop emergence. Controls annual grasses and small seeded broadleaf weeds. Provides early season control of yellow nutsedge with some suppression of purple nutsedge.					

Preemergence (PRE) Herbicides for Weed Management in Sunflower (cont)

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			
<i>sulfentrazone</i> Spartan 4F	3.0-6.0 fl oz	0.094-0.188 lb	14	None	12 hours

Comments: Apply SPARTAN at planting or up to 3 days after planting, but prior to crop emergence. SPARTAN can cause sunflower injury at high rates on light soil. Do not apply to soils classified as SANDS with less than 1.0% organic matter. Do not apply more than 8.0 fl oz/A of SPARTAN per growing season.

<i>s-metolachlor</i> +		0.94-1.23 lb	15	None	24 hours
<i>sulfentrazone</i> Authority Elite 7.0EC	19-25 fl oz	0.10-0.14 lb	14		

Comments: Apply AUTHORITY ELITE as a broadcast surface application at planting or up to 3 days after planting.. Plant sunflower seed 1.5 inches deep and completely cover with soil. Do not apply SPARTAN CHARGE after crop emergence or if the seedling is close to the soil surface as crop response may occur. Do not apply more than 38.7 fl oz AUTHORITY ELITE per acre/year. Do not allow livestock to graze or feed in treated area. Do not apply after seed germination. Do not use on soils classified as sands, which have less than 1% organic matter.

Postemergence (POST) Herbicides for Weed Management in Sunflower

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>clethodim</i>		0.09-0.25 lb	1	70 days	24 hours
Select 2EC	6.0-16.0 fl oz				
SelectMAX 0.97EC	12.0-32.0 fl oz				

Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 8 oz/A (12-14 oz/A SELECT MAX) up to 24" tall. A second 6 oz/A (6-18 oz/A SELECT MAX) treatment may be applied to control regrowth. For bermudagrass, treat 6" runners with 8 oz/A (16 oz/A SELECT MAX), and then apply a second application of 8 oz/A (16 oz/A SELECT MAX) to 6" re-growth. Add a nonionic surfactant at 0.25% v/v or crop oil concentrate at 1 qt/A plus ammonium sulfate at 2.5 lb/A for enhanced johnsongrass and volunteer corn activity. Consult label for tank mix partners. **Rainfast interval = 1 hour.**

<i>imazamox</i>		0.031-0.047 lb	2	None	4 hours
Beyond 1AS	4.0-6.0 fl oz				

Comments: USE ONLY ON CLEARFIELD OR CLEARFIELD PLUS SUNFLOWER VARIETIES. For best results, use a foundation soil applied herbicide at or before planting. Apply *imazamox* to sunflowers from the 2- to 8-leaf growth stage before broadleaf weeds exceed 3 inches in height. *Imazamox* use rate is lower for CLEARFIELD SUNFLOWER VARIETES (4.0 fl oz/A maximum). A NIS at 2 qt per 100 gal of spray solution and liquid nitrogen at 1-2 qt/A or ammonium sulfate at 1.5-3 lb/A must be added to the tank mix. Weed control performance may be enhanced in CLEARFIELD PLUS SUNFLOWER by substituting COC, MSO, HSOC for NIS. **Rainfast interval = 1 hour.**

<i>pyroxyulfone</i>		0.057-0.162 lb	15	60 days	12 hours
Zidua SC 4.17SC	1.75-5.0 fl oz				

Comments: Apply ZIDUA SC as a broadcast spray to sunflower from the first true leaf (leaf at least 1.5 inches long, V1 growth stage) through the 8-leaf growth stage (V8). Do not apply ZIDUA SC to sunflower at the cracking or cotyledon growth stage. Weeds emerged at the time of application must be controlled with cultivation, or a tank mix or sequential program with another labeled herbicide. Postemergence applications of ZIDUA SC may cause temporary leaf burn and stunting, but a reduction in sunflower yield is not expected. Do not apply more than 2.5 fl oz/A of ZIDUA SC on coarse textured soils per cropping season. ZIDUA SC may be tank mixed with POAST or PROWL.

<i>quizalofop</i>		0.034-0.069 lb	1	60 days	12 hours
Assure II 0.88E	5-12 fl oz				

Comments: Apply ASSURE II 7-8 oz/A over-the-top sunflowers to control annual grasses up to 6" tall. For control of rhizome johnsongrass, apply 5 oz of Assure II when johnsongrass is 10-24" tall and then retreat with 5 oz when regrowth reaches 6-10" tall. For bermudagrass control, apply 10-12 oz/A at 3" tall (up to 6" runners). Wait a minimum of 7 days between applications to allow for adequate regrowth. Add crop oil concentrate at 1 gal/100 gallons or nonionic surfactant at 1 qt/100 gallons of spray mixture. Do not exceed 18 oz/A in a growing season. Do not apply ASSURE II after pod set. **Rainfast interval = 1 hour.**

<i>sethoxydim</i>		0.19-0.28 lb	1	75 days	12 hours
Poast 1.5E	1.0-1.5 pt				

Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 1.5 pt/A up to 25" tall. A second 1.0 pt/A treatment may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A, and then apply a second application of 1.0 pt/A to 4" re-growth. Add 1 pt/A of DASH HC or SUNDANCE HC adjuvant or crop oil concentrate at 2 pt/A. Include liquid nitrogen at 4-8 pt/A or ammonium sulfate at 2.5 lb/A for enhanced crabgrass activity. Consult label for tank mix partners. Do not apply more than 2.5 pt/A per season. Do not use POAST on inbred sunflower lines grown for seed. **Rainfast interval = 1 hour.**

Hooded Sprayer Herbicides for Weed Management in Sunflower

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i> Aim 2EC		0.016-0.032 lb	14	---	12 hours
	1.0-2.0 fl oz				

Comments: Apply AIM using a hooded or shielded sprayer toward the base of the plant to avoid contact with the sunflower foliage or green tissue. Controls velvetleaf, annual morningglory, and pigweeds. Add 1 qt of nonionic surfactant per 100 gallons of spray solution. Do not apply more than 4.1 fl oz/A of AIM in-season as a row-middle application. Do not apply more than 6.1 fl oz/A of AIM from all applications per growing season. Do not apply to foliage that is wet from dew, rain, or irrigation. **Rainfast interval = 6 to 8 hours.**

<i>glyphosate</i> (various)	22-32 fl oz	0.75-1.13 lb ae	9	7 days	4 hours
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Comments: Apply GLYHOSATE to row middles using hooded or shielded sprayer that prevents spray contact with sunflower foliage or green tissue. Do not apply more than a combined 22 fl oz/A of GLYPHOSATE from preplant through hooded sprayer applications. Do not graze or feed treated sunflower forage following application of GLYPHOSATE. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

Harvest Aids for Sunflower

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>flumioxazin</i> Valor SX Valor EZ 4SC		0.032-0.064 lb	14	5 days	12 hours
	1.5-2.0 oz				
	1.5-2.0 fl oz				

Comments: Apply VALOR SX when sunflowers are physiologically mature (when seed is 35% moisture or less). To ensure thorough coverage, use a minimum of 15 gallons per acre. Add methylated seed oil which contains at least 15% emulsifiers and 80% oil at 1 qt/A. A spray grade nitrogen source (ammonium sulfate at 2-2.5lb/A or a 28-32% nitrogen solution at 1-2 qt/A) may be added to the spray mixture along with methylated seed oil to enhance dessication. Tank mixing GLYPHOSATE or PARAQUAT will increase the control of emerged weeds and aid in harvest of sunflowers.

<i>glyphosate</i> (various)	22 fl oz	0.75 lb ae	9	7 days	4 hours
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Comments: Apply GLYHOSATE when sunflowers are physiologically mature indicated by the backsides of the flowers are yellow and bracts are turning brown, and seed moisture is less than 35%. Do not exceed 22 fl oz/A of GLYPHOSATE for a preharvest application. Do not graze or feed treated sunflower forage following application of GLYPHOSATE. **Rainfast interval = heavy rainfall soon after application may wash product off of the foliage and a repeat application may be needed to ensure adequate weed control (suggest 1 hour).**

<i>paraquat</i> 2S <i>paraquat</i> 3S	1.2-2.0 pt 0.8-1.3 pt	0.3-0.5 lb	22	7 days	24 hours
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Comments: PARAQUAT is a RESTRICTED USE PESTICIDE. Apply PARAQUAT a minimum of 10 gallons of spray per acre (5 gallons by air) when sunflowers are physiologically mature (when seed is 35% moisture or less). Add non-ionic surfactant at 2 qt/100 gallons of spray solution. Do not make more than 2 applications per year (harvest aid). Do not graze treated areas or feed treated forage to livestock.

Weed Response to Herbicides for Sunflower Weed Management¹

	PPI ²	PPI ² or PRE ³			PRE ³		POSTEMERGENCE						HOOD
	Sonalan/Treflan	Dual Magnum	Prowl	Spartan	Spartan Charge	Zidua SC	Assure II	Beyond ⁴	Poast	Select/MAX	Zidua SC	Aim	Glyphosate
anoda, spurred	P	P	P	G	G	---	P	F	P	P	---	F	GE
barnyardgrass	E	GE	E	F	F	E	GE	F	GE	GE	E	G	E
beggarweed, Florida	P	P	P	E	E	P	P	---	P	P	P	F	G
Bermudagrass	P	P	P	P	P	P	GE	P	FG	G	P	P	G
citronmelon	P	P	P	---	---	P	P	P	P	P	P	P	G
cocklebur, common	P	P	P	GE	GE	P	P	E	P	P	P	GE	E
cowpea	P	P	P	P	P	P	P	P	P	P	P	P	G
crabgrass	E	E	E	FG	FG	E	E	FG	GE	GE	E	P	E
crotalaria, showy	---	P	P	---	---	P	P	P	P	P	P	F	G
croton, tropic	P	P	P	G	G	---	P	P	P	P	---	G	GE
crowfootgrass	E	E	E	F	F	E	E	FG	FG	G	E	P	E
dayflower, Benghal	P	G	P	---	---	GE	P	---	P	P	GE	---	G
eclipta	---	---	---	GE	GE	---	P	---	P	P	---	FG	E
goosegrass	E	E	E	FG	FG	GE	E	FG	GE	GE	GE	P	E
jimsonweed	P	P	P	E	E	GE	P	E	P	P	GE	GE	E
johnsongrass, rhizome	P	P	P	P	P	GE	G	P	G	GE	GE	P	E
johnsongrass, seedling	E	F	E	F	F	P	E	FG	GE	GE	P	P	E
lambsquarters, common	GE	F	GE	E	E	G	P	G	P	P	G	P	E
morningglory spp.	P	P	P	E	E	P	P	FG	P	P	P	G	FG
nutsedge, purple	P	P	P	E	E	P	P	FG	P	P	P	P	G
nutsedge, yellow	P	FG	P	E	E	FG	P	FG	P	P	FG	P	FG
panicum, fall	E	G	E	FG	FG	GE	E	FG	GE	E	GE	P	E
panicum, Texas	GE	PF	GE	F	F	FG	E	F	GE	GE	FG	P	E
pigweed spp.	E	E	FG	E	E	GE	P	F	P	P	GE	G	E
ALS-resistant	E	E	FG	E	E	GE	P	P	P	P	GE	G	E
DNA-resistant	P	E	P	E	E	GE	P	F	P	P	GE	G	E
glyphosate-resistant	E	E	FG	E	E	GE	P	F	P	P	GE	G	P
poinsettia, wild	P	P	P	---	---	---	P	---	P	P	---	GE	GE
purslane, common	GE	G	GE	F	F	---	P	P	P	P	---	F	P
pusley, Florida	E	G	E	FG	FG	G	P	---	P	P	G	G	PF
ragweed, common	P	P	P	P	P	---	P	F	P	P	---	E	GE
redweed				G	G	G	P	---	P	P	G	G	G
sandbur	E	G	GE	PF	PF	GE	E	FG	G	G	GE	P	E
senna, coffee	P	P	P	G	G	---	P	P	P	P	---	FG	GE
sesbania, hemp	P	P	P	GE	GE	---	P	---	P	P	---	G	PF
sicklepod	P	P	P	P	P	F	P	P	P	P	F	P	E
sida, prickly	P	P	P	P	P	G	P	G	P	P	G	G	G
signalgrass, broadleaf	G	FG	G	F	F	G	E	FG	GE	GE	G	P	E
smartweed, Pennsylvania	---	P	P	P	P	P	P	---	P	P	P	G	E
spurge	P	PF	P	G	G	G	P	---	P	P	G	FG	G
starbur, bristly	P	P	P	---	---	---	P	---	P	P	---	GE	GE
velvetleaf	P	P	P	E	E	P	P	E	P	P	P	G	GE

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 50 to 80%; P = poor control, < 50%; -- = Insufficient Data.

²PPI = Preplant incorporated

³PRE = Preemergence

⁴Use only on Clearfield sunflower varieties

WEED CONTROL IN TOBACCO

Mike Marshall, Extension Weed Specialist

Preplant Incorporated Herbicides for Weed Management in Tobacco

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>clomazone</i> Command 3ME	2.0-2.67 pt	0.75-1.0 lb	13	65 days	12 hours
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Comments: Apply COMMAND to the soil surface as a broadcast spray and incorporate using shallow tillage (less than 2 inches). Excellent control of prickly sida and annual grasses. Good control of ragweed. See label for other restrictions and drift control measures. COMMAND may persist and cause injury to small grain cover crops, see label for details. COMMAND may be applied up to 7 days after transplanting.

<i>napropamide</i> Devrinol 2EC Devrinol 50DF	2.0-4.0 qt 2.0-4.0 lb	1.0-2.0 lb	15	70 days	24 hours
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Comments: Apply DEVRINOL preplant incorporated by shallow disking. Controls pigweed, ragweed and other broadleaf weeds. Use the higher rate for fields with a history of heavy weed infestations. Will not control morningglories. Do not exceed 2.0 lb ai/A DEVRINOL per cropping season. Do not apply DEVRINOL more than once per cropping season.

<i>pebulate</i> Tillam 6E	2.67 qt	6.0 lb	8	---	12 hours
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Comments: Apply TILLAM and incorporate immediately to prevent evaporation of TILLAM with a tandem disk set to cut 6" deep. For best results, run the tandem disk in two different directions (cross disk). Drag with a spike tooth harrow or cultipack to help seal TILLAM in soil. Provides good control of most grasses and nutsedge. TILLAM is not persistent in the soil and weeds germinating late in the season will not be controlled.

<i>pebulate</i> Tillam 6E +	2.67 qt +	6.0 lb	8	70 days	12 hours
<i>napropamide</i> Devrinol 2EC Devrinol 50DF/DF-XT	2.0-4.0 qt 2.0-4.0 lb	1.0-2.0 lb	15		

Comments: Apply DEVRINOL + TILLAM preplant incorporated by shallow disking. This combination will provide control of nutsedge and annual grasses and broadleaves. Apply up to 3 weeks before transplanting. Do not apply more than 1 gallon/A of DEVRINOL 2EC per season. Do not make more than 1 application of DEVRINOL per season. Use lower rate on coarse textured soils.

<i>pendimethalin</i> Prowl H2O 3.8EC Prowl 3.3E	2.0 pt 2.4 pt	0.95 lb 0.99 lb	3	---	24 hours
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Comments: Apply PROWL broadcast on the soil surface and incorporate up to 60 days before transplanting. Increase rate where weed pressure is heavy. Controls small seeded annual grasses and broadleaf weeds.

Pretransplant (Surface Applied) Herbicides for Weed Management in Tobacco

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i>		0.016-0.028 lb	14	---	12 hours
+		+			
<i>sulfentrazone</i>		0.16-0.25 lb	14		
Spartan Charge 3.5F	5.7-10.2 fl oz				

Comments: Apply SPARTAN CHARGE to the soil surface following land preparation from 14 days up to 12 hours before transplanting. If beds are formed before transplanting, the top of the beds should be knocked down prior to application of SPARTAN CHARGE. SPARTAN CHARGE will provide postemergence activity on weeds (less than 3 inches in height) present at the time of application. Sprayer calibration and good agitation are essential with application of SPARTAN CHARGE. Avoid excessive overlap of spray swaths. Excellent control of morningglory, pigweeds, lambsquarters, and yellow/purple nutsedge. Do not apply SPARTAN CHARGE over the top of transplanted tobacco as crop injury may occur. Tank mix with COMMAND or PROWL for improved grass control. Do not apply more than 15.2 fl oz/A of SPARTAN CHARGE per 12-month period. Do not apply SPARTAN CHARGE to soils classified as sands with less than 1.0% organic matter.

<i>sulfentrazone</i>		0.19-0.25 lb	14	---	12 hours
Spartan 4F	6.0-8.0 fl oz				

Comments: Apply SPARTAN 4F to the soil surface following land preparation from 14 days up to 12 hours before transplanting. If beds are formed before transplanting, the top of the beds should be knocked down prior to application of SPARTAN. Sprayer calibration and good agitation are essential with application of SPARTAN. Avoid excessive overlap of spray swaths. Excellent control of morningglory, pigweed, lambsquarters and yellow nutsedge. Do not apply SPARTAN over the top of transplanted tobacco as crop injury may occur. Tank mix with COMMAND or PROWL for improved grass control. Do not apply more than 12 fl oz/A of SPARTAN per 12-month period. Do not apply SPARTAN to soils classified as sands with less than 1.0% organic matter. Do not use SPARTAN in tobacco seeding beds or greenhouses.

At-Transplant Postemergence Broadcast Herbicides for Weed Management in Tobacco

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>clomazone</i>		6.0 lb	13	65 days	12 hours
Command 3ME	2.0-2.67 pt				

Comments: Apply COMMAND over-the-top of transplants immediately after setting to provide soil residual control of small seeded annual grasses and broadleaves. Use the higher rate for fields with a history of weed problems. If possible, irrigate with a half inch of water if no rainfall occurs within 3 to 5 days.

<i>napropamide</i>		1.0-2.0 lb	15	70 days	24 hours
Devrinol 50DF/DF-XT	2.0-4.0 lb				
Devrinol 2EC	2.0-4.0 qt				

Comments: Apply DEVRINOL over-the-top of transplants immediately after setting to provide soil residual control of small seeded annual grasses and broadleaves. Use the higher rate for fields with a history of weed problems. If rainfall does not occur within 5 days, shallowly incorporate or irrigate with sufficient water to wet soil to a depth of 2 to 4 inches. Do not apply more than 4 lb DEVRINOL per season.

Post-Transplant Postemergence Directed Herbicides for Weed Management in Tobacco

Herbicide	Rate/Acre Broadcast		Mode of Action	Preharvest Interval	Restricted Entry Interval
	Formulation	Active Ingredient			

<i>carfentrazone</i>		0.0125-0.024 lb	14	6 days	12 hours
Aim 2EC	0.8-1.5 fl oz				

Comments: Apply AIM using a shielded or hooded sprayer to weeds that are emerged and actively growing before layby (less than 3 inches in height). Add crop oil concentrate (COC) at 1 gal per 100 gal of spray solution. Coverage is essential for maximum efficacy on target weeds. Do not apply AIM when conditions favor drift. Do not allow spray to contact tobacco foliage or green stem tissue as severe crop injury may occur. Do not apply more than 3.06 fl oz AIM per acre per season. **Rainfast interval = 6 hours.**

<i>napropamide</i>		1.0 lb	15	70 days	12 hours
Devrinol 50DF	2.0 lb				
Devrinol DF-XT	2.0 lb				
Devrinol 2EC	4 qt				

Comments: Apply following last cultivation. Direct spray into row middles using drop nozzles. Provides only residual control. No activity on emerged weeds. If rainfall does not occur within 5 days, shallowly incorporate or irrigate with sufficient water to wet soil to a depth of 2 to 4 inches. Do not apply more than 4 lb/A of DEVRINOL per season.

<i>pendimethalin</i>		0.71-0.95 lb	3	N/A	24 hours
Prowl H2O 3.8EC	1.5-2.0 pt				
Prowl 3.3 EC	1.8-2.4 pt	0.74-0.99 lb			

Comments: Apply 4 to 6 weeks after transplanting in a 16 to 24-inch directed band between crop rows. Spray should not contact the tobacco leaves. Use the higher product rate where weed pressure is heavy. Controls most annual grasses and pigweeds. No activity on emerged weeds.

<i>sethoxydim</i>		0.19-0.28 lb	1	42 days	12 hours
Poast 1.5E	1.0-1.5 pt				

Comments: Apply anytime during crop growth before annual grasses exceed 4-6" tall. For rhizome johnsongrass, apply 1.5 pt/A up to 25" tall. A second 1.0 pt/A treatment may be applied to control regrowth up to 12" tall. For bermudagrass, treat 6" runners with 1.5 pt/A, and then apply a second application of 1.0 pt/A to 4" re-growth. Add 1 pt/A of DASH HC or SUNDANCE HC adjuvant or COC 2 pt/A plus UAN at 4-8 pt/A or AMS at 2.5 lb/A. Do not apply more than 4.0 pt/A per season of POAST. **Rainfast interval = 1 hour.**

Weed Response to Herbicides for Tobacco Weed Management¹

	PRE-TRANSPLANT							POST-TRANSPLANT					
	PPI ²					PRE ³		AT-PT ⁴		LAYBY DIRECTED			
	Command	Devrinol	Prowl	Tillam	Devrinol + Tillam	Spartan	Spartan Charge	Command	Devrinol DF-Xt	Poast	Aim	Devrinol DF-Xt	Prowl
anoda, spurred	E	---	P	---	---	G	G	E	---	P	F	---	P
barnyardgrass	GE	GE	E	GE	GE	F	F	GE	GE	GE	G	GE	E
beggarweed, Florida	---	---	P	---	---	E	E	---	---	P	F	---	P
Bermudagrass	PF	P	P	P	P	P	P	PF	P	G	P	P	P
citronmelon	G	P	P	P	P	---	---	G	P	P	P	P	P
cocklebur, common	F	P	P	P	P	GE	GE	F	P	P	GE	P	P
cowpea	P	P	P	P	P	P	P	P	P	P	P	P	P
crabgrass	E	E	E	E	E	FG	FG	E	E	E	P	E	E
crotalaria, showy	---	P	P	P	P	---	---	---	P	P	F	P	P
croton, tropic	G	---	P	---	---	G	G	G	---	P	G	---	P
crowfootgrass	G	E	E	E	E	F	F	G	E	E	P	E	E
dayflower, Benghal	F	---	P	---	---	---	---	F	---	P	---	---	P
eclipta	G	---	---	---	---	GE	GE	G	---	P	FG	---	---
goosegrass	G	E	E	E	E	FG	FG	G	E	E	P	E	E
jimsonweed	FG	---	P	---	---	E	E	FG	---	P	GE	---	P
johnsongrass, rhizome	F	P	P	P	P	P	P	F	P	GE	P	P	P
johnsongrass, seedling	P	F	E	F	F	F	F	P	F	E	P	F	E
lambsquarters, common	GE	G	GE	G	G	E	E	GE	G	P	P	G	GE
morningglory spp.	P	P	P	P	P	E	E	P	P	P	G	P	P
nutsedge, purple	P	P	P	P	P	E	E	P	P	P	P	P	P
nutsedge, yellow	P	P	P	P	P	E	E	P	P	P	P	P	P
panicum, fall	G	G	E	G	G	FG	FG	G	G	P	P	G	E
panicum, Texas	FG	---	GE	---	---	F	F	FG	---	G	P	---	GE
pigweed spp.	PF	G	FG	G	G	E	E	PF	G	P	E	G	FG
DNA resistant	PF	G	FG	G	G	E	E	PF	G	P	E	G	FG
poinsettia, wild	P	---	P	---	---	---	---	P	---	P	GE	---	P
purslane, common	G	GE	GE	GE	GE	F	F	G	GE	P	F	GE	GE
pusley, Florida	E	GE	E	GE	GE	FG	FG	E	GE	P	G	GE	E
ragweed, common	P	P	P	P	P	P	P	P	P	P	E	P	P
redweed	---	---	---	---	---	G	G	---	---	P	G	---	---
sandbur	E	G	GE	G	G	PF	PF	E	G	G	P	G	E
sesbania, hemp	P	---	P	---	---	G	G	P	---	P	FG	---	P
sicklepod	P	P	P	P	P	GE	GE	P	P	P	G	P	P
sida, prickly	P	P	P	P	P	P	P	P	P	P	P	P	P
signalgrass, broadleaf	G	G	P	G	G	P	P	G	G	GE	G	G	G
smartweed, Pennsylvania	P	P	G	P	P	F	F	P	P	P	P	P	P
spurge	---	---	P	---	---	P	P	---	---	P	G	---	P
starbur, bristly	P	---	P	---	---	G	G	P	---	P	FG	---	P
velvetleaf	P	---	P	---	---	---	---	P	---	P	GE	---	P

¹Key to Response Ratings: E = excellent control, 90% or better; G = good control, 80 to 90%; F = fair control, 70 to 80%; P = poor control, 70% or less; --- = Insufficient Data.

²PPI = Preplant Incorporated

³PRE = Preemergence

⁴AT-PT = At Transplant/Postemergence after Transplant

TOBACCO INSECT CONTROL

Francis P. F. Reay-Jones, Extension Entomologist

Integrated pest management (IPM) is the ecological approach to pest control. It uses ALL suitable techniques to reduce pests below economic levels. It is not the intention of IPM to do away with chemicals. If anything, IPM is designed to protect chemicals from being lost or becoming ineffective.

When insect pest populations reach economic threshold levels, control measures must be taken. The ultimate line of defense against insect enemies is the use of chemicals. These control costs can be very expensive, but the cost of not controlling could be total crop destruction. With IPM, when chemicals are used, it is because they are necessary; facts replace hunches.

IPM is needed even in high cash crops such as tobacco. Indiscriminate use of insecticides destroys beneficial insects. This can cause minor or secondary pests to become major pests and major pests to reach serious levels earlier. Overuse of insecticides may also contribute to a resistance buildup by the pests and make control even harder.

In order to reduce selection pressure on any given active ingredient, we recommend that growers avoid using insecticides with the same mode of action on consecutive generations of a pest if multiple applications are required during a growing season. Rotation among insecticides with different modes of action is recommended. This will help to maintain the efficacy of labeled products. To help with selection of insecticides, modes of action of insecticides are indicating in the recommendations below using the classification defined by the Insecticide Resistance Action Committee (<http://www.irac-online.org>). A different number indicates a different mode of action.

Natural Control - This includes weather, beneficial insects, diseases, etc., and results in the death of most insect pests (sometimes as many as 95-97%). Perhaps as many as 50%, or even more, of the potential insect pests are destroyed by beneficial insects before they can do much damage to tobacco. Beneficial insects are very important.

Economic Threshold - This is a level at which a treatment would be profitable and a decision to treat should be made. Economic thresholds may be affected by such things as location, size of insects, presence of beneficials, time of growing season, stage of growth, and the size and condition of the tobacco plant. Economic thresholds are continually changing. When in doubt, consult with your county Extension agent.

Current economic thresholds are:

Tobacco budworms - Treat when four or more plants out of 100 (4%) are infested with budworms during the first 4 weeks after transplanting. After the fourth week and until plants have buttoned, treat when 10 or more plants out of 100 (10%) are infested. When using CU-263, you may be able to wait a little longer before treatment.

Tobacco hornworms - Treat when 10 or more worms (without parasite cocoons) are found per 100 plants (10%). Worms having white parasite cocoons eat much less, and more of these can be tolerated before treatment is required.

Aphids - Treat when 10% of the plants checked have 50 or more live aphids on at least one leaf.

Flea beetles - Treat when there is an average of three flea beetles per plant early in the season, when the tobacco is small, or an average of 20 flea beetles per plant late in the season, when the tobacco is large. Flea beetles are normally a problem only early in the season (shortly after transplanting) and late in the season (when the harvest of lower leaves moves the flea beetles up the stalk).

Cutworms - Treat when 10% of the plants checked show cutworm damage.

Scouting - Scouting tobacco for various pests was part of the Tobacco IPM program that began in Dillon County in 1979. The program expanded to Florence and Horry counties in 1982 and to Marion County in 1983. Private scouting began in 1984, and continues. Ultimately, we hope that all tobacco in this state will be scouted at least once a week for all crop pests, by trained scouts or by the growers.

THRIPS

Thrips are responsible for the transmission of tomato spotted wilt virus (TSWV) in tobacco. Thrips are very tiny insects, barely visible with the naked eye. Although there are many different kinds of thrips found on tobacco, only three of those species are capable of transmitting the disease. One of those, *Frankliniella fusca* (the tobacco thrips), is the most common thrips found on tobacco.

Transmission of the disease seems to be most common during a fairly short period of time early in the season. Insecticide applications to control the thrips seem to provide very little help in controlling the disease. By the time that the insecticide kills the thrips, they have already transmitted the disease. The application of Admire (or generic brands of imidacloprid) or Platinum insecticides prior to transplanting does provide some suppression of the disease.

APHIDS

For several years now, we have been seeing fewer green aphids and more red aphids, with the latter being more difficult to control. Some taxonomic work suggested that the aphid that we have had on tobacco for the past few decades was not the green peach aphid, *Myzus persicae*. A new species, the tobacco aphid (*Myzus nicotianae*), was described. We have now come full circle. Other taxonomists have looked at the situation and come to the conclusion that these are both the same species, the green peach aphid. The green peach aphid does come in both a red and green color form, with the red generally being more difficult to control.

Aphids secrete a sugary substance known as honeydew. Honeydew is sticky, and a perfect site for the development of sooty mold. Once honeydew and sooty mold are present on the leaves, they are nearly impossible to get off. As aphids molt, they leave their cast skins behind. I have received numerous calls from growers (by the way of the county agents) who complained of getting poor control of aphids with Orthene. When I examined the situation, what I found was tobacco leaves covered with cast skins, honeydew, and sooty mold. There were no live aphids. Orthene will kill the aphids, but it will not (nor will anything else) get rid of the cast skins and damage.

Tobacco that has been damaged by aphids will carry that damage all the way to the warehouse floor. Leaves will be thinner, black, and stuck together. The result is a mess. The tobacco is of very poor quality and, justifiably, brings a lower price. The way to avoid aphid damage to your tobacco is to control the aphids before they build up to such high numbers.

The red form of the green peach aphid is more difficult to control than the green form. Both Admire (and generic brands of imidacloprid) and Platinum used in the greenhouse will give excellent control of the red and green forms of the green peach aphid.

PRECAUTIONS USING INSECTICIDES

ALL insecticides should be applied according to label precautions and restrictions.

TOBACCO INSECT CONTROL IN THE PLANT BED

INSECT	PRODUCT {MODE OF ACTION GROUP}*	AMOUNT PER 1000 SQ FT	MIXING AND APPLICATION	REI
Aphids & Flea Beetles	Acephate (Orthene 97) {1B}	3/4 ** tbsp	Mix spray using 3/4 tbsp per 1 gal water/1000 sq ft.	24
Cutworms	Acephate (Orthene 97) {1B}	3/4 tbsp	Mix spray using 3/4 tbsp per 1 gal water/1000 sq ft.	24
Slugs or Snails	Metaldehyde 5B	2 lb	Scatter around margins, walkways, and open spaces in beds.	12

* Modes of action of insecticides are indicating using the classification defined by the Insecticide Resistance Action Committee (<http://www.irac-online.org>).

** tbsp = tablespoon

TOBACCO INSECT CONTROL IN GREENHOUSES OR IN TRANSPLANT WATER

Acephate (Orthene 97) is labeled for use on tobacco in greenhouses to control cutworms, flea beetles, the green peach aphid, and the tobacco aphid, at a rate of ¾ lb/A. Apply to foliage at the equivalent of 3/4 tbsp in 3 gal water/1000 sq ft of bed. Apply evenly to ensure thorough coverage. Note: Floatbed water should be disposed of in the transplanted field through the transplant water or through foliar spray.

Imidacloprid - Admire Pro has replaced Admire 2F. Both products have the same active ingredient (imidacloprid). However the Admire Pro formulation is more concentrated, therefore the rates will be different. It is labeled at 0.5 fl oz/1000 plants for aphids and flea beetles and 0.6-1.2 fl oz/1000 plants for mole crickets and wireworms. For tomato spotted wilt suppression, use 0.8-1.2 fl oz/1000 plants.

Admire 2F and generic brands are also labeled for use on tobacco as a drench to trays or flats prior to transplanting. Labeled rates are 1 fl oz/1000 plants for aphids and flea beetles and 1.4-2.8 fl oz/1000 plants for mole crickets and wireworms. Although this is a greenhouse application, imidacloprid will control these insects in the field for most of the growing season. For tomato spotted wilt suppression, use 1.8-2.8 fl oz/1000 plants.

Thiamethoxam (Platinum 2 SC) is labeled for use on tobacco as a drench to trays or flats prior to transplanting. It is labeled at 0.8-1.3 fl oz/1000 plants for aphids, flea beetles, and Japanese beetles, and 1.3 fl oz/1000 plants for wireworms. Although this is a greenhouse application, it is for control of these insects in the field. For tomato spotted wilt suppression, use 0.8-1.3 fl oz/1000 plants.

Cloranthraniliprole (Coragen) is labeled for use on tobacco as a drench to trays or flats prior to transplanting. It is labeled at 5.0-7.5 oz/ac for tobacco budworms and tobacco hornworms. Durivo (**Cloranthraniliprole + Thiamethoxam**) is labeled for use on tobacco as a drench to trays or flats prior to transplanting at rates of 0.6-1.6 oz/1,000 plants with combined activity of both insecticides.

Cyantraniliprole (Verimark) is labeled for use on tobacco as a drench to trays or flats prior to transplanting. It is labeled at 10-13.5 oz/ac for tobacco budworm, tobacco hornworm and flea beetle control, and at 13.5 oz/ac for tomato spotted wilt suppression.


An insecticidal soap, **M-Pede**, is also labeled for use on tobacco in the greenhouse. However, its effectiveness has not yet been established.

"ALL insecticides should be applied according to label precautions and restrictions."


TOBACCO INSECT CONTROL IN THE FIELD

INSECT	PRODUCT {MODE OF ACTION GROUP}*	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
WIREWORMS	Ethoprop (Mocap 15 G [R]) {1B}	13 lb	Broadcast granules with spreader or apply sprays evenly over area at least 7-10 days before transplanting and disc to mix 2-4 inches into soil.	48
	Imidacloprid (Admire Pro) {4A}	0.6-1.2 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire Pro) {4A}	0.8-1.2 fl oz/ 1000 plants	Apply in transplant water in a minimum of 100 gal/A.	12
	Imidacloprid (Admire 2F and generic brands) {4A}	1.4-2.8 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire 2F and generic brands) {4A}	1.8-2.8 fl oz/ 1000 plants	Apply in-furrow or transplant water.	12


TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT {MODE OF ACTION GROUP}*	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
WIREWORMS (CONT)	Thiamethoxam (Platinum 2 SC) {4A}	1.3 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting, or in transplant water in a minimum of 100 gal/A.	12
	Thiamethoxam and chlorantraniliprole (Durivo) {4A} {28}	1.6 fl oz/ 1000 plants	Apply at transplant.	-
APHIDS	Acephate (Orthene 97) {1B}	0.5 lb	Apply in 10-50 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	24
	Imidacloprid (Admire Pro) {4A}	0.5 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire Pro) {4A}	0.6 fl oz/ 1000 plants	Apply in transplant water in a minimum of 100 gal/A.	12
	Imidacloprid (Admire 2F and generic brands) {4A}	1.0 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire 2F and generic brands) {4A}	1.4 fl oz/ 1000 plants	Apply in-furrow or transplant water.	12
	Imidacloprid (Provado 1.6 F) {4A}	2-4 oz	Apply in 20-40 gal spray/A for complete coverage. PHI = 14 days	12
	Lambda-cyhalothrin/ chlorantraniliprole (Besiege) {3A} {28}	5-9 oz	Use at least 10 gal spray/ac. PHI = 40 days (suppression only)	12
	Methomyl (Lannate LV [R] or SP [R]) {1A}	1.5 pts or 0.5 lbs.	Apply in 20-40 gal spray/A for complete coverage. PHI = 5 days	48
	Pymetrozine (Fulfill 50 WG) {9B}	2.75 oz	Same as above. Do not make more than two applications per season.	12
	Thiamethoxam (Platinum 2 SC) {4A}	0.8-1.3 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting, or in transplant water in a minimum of 100 gal/A.	12
	Thiamethoxam (Actara) {4A}	2-3 oz	Use at least 20 gal spray/ac. PHI = 14 days.	12
	Thiamethoxam and chlorantraniliprole (Durivo) {4A} {28}	0.6-1.6 fl oz/ 1000 plants	Apply at transplant.	-
	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) {4A} {28}	2.5-4 oz	Use at least 20 gal spray/ac. PHI=14 days	12



TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT {MODE OF ACTION GROUP}*	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
FLEA BEETLES	Acephate (Orthene 97) {1B}	0.5 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Carbaryl (Sevin 80S or 4F) {1A}	1.25-2.5 lb 1-2 qt	Apply in 20-40 gal spray/A for complete coverage. PHI = 0	12
	Cyantraniliprole (Exirel)	13.5-20.5 oz	foliar application (PHI = 7 days)	12
	Cyantraniliprole (Verimark)	10-13.5 oz	Transplant water or greenhouse tray drench	4
	Imidacloprid (Admire Pro) {4A}	0.5 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire Pro) {4A}	0.6 fl oz/ 1000 plants	Apply in transplant water in a minimum of 100 gal/A.	12
	Imidacloprid (Admire 2F and generic brands) {4A}	1.0 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	12
	Imidacloprid (Admire 2F and generic brands) {4A}	1.4 fl oz/ 1000 plants	Apply in-furrow or transplant water.	12
	Imidacloprid (Provado 1.6 F) {4A}	4 oz	Apply in 20-40 gal spray/A for complete coverage. PHI = 14 days	12
	Methomyl (Lannate LV [R] or SP [R]) {1A}	0.75-1.5 pts or 0.25-0.5 lbs	Apply in 20-40 gal spray/A for complete coverage. PHI = 5 days	48
	Thiamethoxam (Platinum 2 SC) {4A}	0.8-1.3 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting, or in transplant water in a minimum of 100 gal/A.	12
	Thiamethoxam (Actara) {4A}	2-3 oz	Use at least 20 gal spray/ac. PHI = 14 days.	12
	Thiamethoxam and chlorantraniliprole (Durivo) {4A} {28}	1.0-1.6 fl oz/ 1000 plants	Apply at transplant.	-
	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) {4A} {28}	2.5-4 oz	Use at least 20 gal spray/ac. PHI=14 days	12





TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT {MODE OF ACTION GROUP}*	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
BUDWORMS	Acephate (Orthene 97) {1B}	0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Bacillus Thuringiensis** {11}	(see label)		
	Bacillus Thuringiensis {11}	5-10 lb	Commercially prepared bait. Place small pinch in bud of each plant with a gloved hand or mechanical applicator.	Bait
	Chlorantraniliprole (Coragen) {28}	3.5-7.5 oz	foliar application (PHI = 1 day)	4
		5.0-7.5 oz	transplant water application at planting	
	Cyantraniliprole (Exirel)	10-20.5 oz	foliar application (PHI = 7 days)	12
	Cyantraniliprole (Verimark)	10-13.5 oz	Transplant water or greenhouse tray drench	4
	Lambda-cyhalothrin (Karate Z) {3A}	0.96-1.92 oz	At least 2 gallons per acre. PHI = 40 days.	24
	Lambda-cyhalothrin/ chlorantraniliprole (Besiege) {3A} {28}	5-9 oz	Use at least 10 gal spray/ac. PHI = 40 days	12
	Methomyl (Lannate LV [R] or SP [R]) {1A}	1.5 pts or 0.5 lbs.	Use at least 10 gal spray/ac. PHI = 5 days	48
	Spinosad (Blackhawk){5}	1.6-3.2 oz	Use at least 20 gal spray/ac. PHI = 3 days.	4
	Thiamethoxam and chlorantraniliprole (Durivo) {4A} {28}	1.6 fl oz/ 1000 plants	Apply at transplant.	-
	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) {4A} {28}	4 oz	Use at least 20 gal spray/ac. PHI=14 days	12

TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT {MODE OF ACTION GROUP}*	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
 <p>HORNWORMS</p>	Acephate (Orthene 97) {1B}	0.5 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Bacillus Thuringiensis** {11}	(see label)		
	Carbaryl (Sevin 80S or 4F) {1A}	1.25-2.5 lb 1-2 qt	Apply in 20-40 gal spray/A for complete coverage. PHI = 0	12
	Chlorantraniliprole (Coragen) {28}	3.5-7.5 oz	foliar application (PHI = 1 day)	4
		5.0-7.5 oz	transplant water appl. at planting	
	Cyantraniliprole (Exirel)	13.5-20.5 oz	foliar application (PHI = 7 days)	12
	Cyantraniliprole (Verimark)	10-13.5 oz	Transplant water or greenhouse tray drench	4
	Lambda-cyhalothrin (Karate Z) {3A}	0.96-1.92 oz	At least 2 gallons per acre. PHI = 40 days.	24
	Lambda-cyhalothrin/ chlorantraniliprole (Besiege) {3A} {28}	5-9 oz	Use at least 10 gal spray/ac. PHI = 40 days	12
		Methomyl (Lannate LV [R] or SP [R]) {1A}	0.75-1.5 pts 0.25-0.5 lbs	Use at least 10 gal spray/ac. PHI = 5 days
	Spinosad (Tracer or Blackhawk){5}	1.4-2.9 oz or 1.6-3.2 oz	Use at least 20 gal spray/ac. PHI = 3 days.	4
Thiamethoxam and chlorantraniliprole (Durivo) {4A} {28}	1.6 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting.	-	
<p>HORNWORMS (cont.)</p>	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) {4A} {28}	4 oz	Use at least 20 gal spray/ac. PHI=14 days	12
 <p>LOOPERS</p>	Acephate (Orthene 97) {1B}	0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Bacillus thuringiensis** {11}	(see label)		
	Methomyl (Lannate LV [R] or SP [R]) {1A}	1.5 pts 0.5 lbs	Use at least 10 gal spray/ac. PHI = 5 days.	48



TOBACCO INSECT CONTROL IN THE FIELD (cont)

INSECT	PRODUCT {MODE OF ACTION GROUP}*	AMOUNT PER ACRE	MIXING AND APPLICATION	REI (hrs)
GRASSHOPPERS	Acephate (Orthene 97) {1B}	0.25-0.5 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
STINK BUGS 	Acephate (Orthene 97) {1B}	0.5-0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Chlorantraniliprole (Coragen) {28}	3.5-7.5 oz	foliar application. PHI = 1 day	4
JAPANESE BEETLES 	Carbaryl (Sevin 80S or 4F) {1A}	1.25-2.5 lb 1-2 qt	Apply in 20-40 gal spray/A for complete coverage. PHI = 0	12
	Acephate (Orthene 97) {1B}	0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
	Imidacloprid (Provado 1.6 F) {4A}	4 oz	Apply in 20-40 gal spray/A for complete coverage. PHI = 14 days	12
	Thiamethoxam (Actara) {4A}	2-3 oz	Use at least 20 gal spray/ac. PHI = 14 days.	12
	Thiamethoxam (Platinum 2 SC) {4A}	0.8-1.3 fl oz/ 1000 plants	Apply as a drench to flats or trays prior to transplanting, or in transplant water in a minimum of 100 gal/A.	12
	Thiamethoxam/ chlorantraniliprole (Voliam Flexi) {4A} {28}	2.5-4 oz	Use at least 20 gal spray/ac. PHI=14 days	12
CUTWORMS 	Acephate (Orthene 97) {1B}	0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12
VEGETABLE WEEVILS 	Acephate (Orthene 97) {1B}	0.5 to 0.75 lb	Apply in 20-40 gal spray/A for complete coverage or in transplant water in a minimum of 100 gal/A. PHI = 3 days	12

* Modes of action of insecticides are indicating using the classification defined by the Insecticide Resistance Action Committee (<http://www.irac-online.org>).

** *Bt* products labeled for use on tobacco in South Carolina include Dipel, Biobit, Thuricide, MVP, Lepinox and Agree.

ON-FARM CONTROL OF TOBACCO MOTH AND CIGARETTE BEETLE

INSECTICIDE	DOSAGE	HOW, WHERE, AND WHEN TO APPLY
<p>Heat treatment</p> <p>Tobacco moth and Cigarette beetle (all stages)</p>	<p>140°F</p> 	<p>Hang in barn for a few hours.</p> <p>CAUTION: Tobacco must be thoroughly dried at temperature below 100°F before increasing temperature or color will change and result in decreased price.</p>
<p>Dichlorvos (Vapona) Resin strips {1B}</p> <p>Tobacco moth (moth only)</p>	<p>1 per 1,000 cu ft of space</p>	<p>Effective in reasonably tight storage facilities. Hang one resin strip per 1,000 cu ft of storage space. Replace if live moths are noticed.</p>
<p>Bacillus thuringiensis* {11}</p> <p>Tobacco moth (larvae only)</p>	<p>(see label)</p> 	<p>Apply as a fine mist. Spray leaves in layers as tobacco is being sheeted, re-sheeted, or placed in a pile for storage. Good coverage is essential.</p> <p>CAUTION: Avoid excessive moisture.</p>

*The only Bt product labeled for this use in South Carolina is Dipel.

TOBACCO DISEASE MANAGEMENT

General Information

Endemic diseases such as bacterial wilt, black shank and root-knot nematodes always cause significant disease losses in South Carolina. Tomato spotted wilt, target spot, and blue mold also have the potential of causing disease problems in SC as well. These important and potentially devastating diseases of tobacco can best be managed through a combination of control methods. It is urged that growers identify disease problems in their fields and follow disease management suggestions based on rotation, variety selection, sanitation and chemical treatments. A sound disease management strategy cannot be developed without the proper identification of the disease problems in your fields. Disease development is a dynamic process and can change over time. A low disease loss in your fields in the recent past does not assure disease losses will remain low!

Disease Management Strategy

Disease losses affect tobacco yields, quality, and profitability. Disease control options can be expensive to use and costly especially if the wrong control option is chosen. Great care needs to be exercised to assure a return on your control investment.

Rotation: The best defense against most diseases and the least expensive is a good, well-planned rotation. However, the diseases must be correctly identified within particular fields to develop a sound rotation plan. Any rotation is better than no rotation, but certain crops will do a better job of suppressing certain diseases. While some growers take a chance and do not rotate, sooner or later they will get caught with unexpected losses. Some diseases, such as bacterial wilt or black shank, may destroy entire fields! Also, some diseases such as mosaic and nematodes may be causing more damage than realized through observation because the plant may not completely die. Losses to these diseases are easily masked in a year in which rainfall was plentiful. Although difficult to see, these losses substantially reduce farm income! Losses to the three major diseases in South Carolina, that consistently reduce yields from year to year, can be reduced through a planned rotation program.

Host Resistance: Selection of resistant varieties provides a highly effective and inexpensive method of reducing losses to disease. Varieties differ in resistance to black shank, bacterial wilt, tobacco mosaic, Fusarium wilt and root-knot nematodes, so any one variety will not be the best choice in all fields. Study the disease ratings within the tobacco production guide to select appropriate varieties for your farm.

Chemical Treatments: Selection of chemical treatments should be your LAST CONSIDERATION in a disease control strategy. Rotation, variety selection and proper sanitation reduce populations of pathogenic organisms to levels that can be controlled by chemical applications. Choose your chemicals to match the disease pressure in your fields.

Bacterial Wilt Control

Bacterial wilt is the most serious of the soil-borne diseases of tobacco in South Carolina. It is very difficult to manage. The disease is concentrated in the eastern-most counties in the Pee Dee Region, but is present and increasing in severity in other important tobacco-producing counties.

Symptoms of bacterial wilt appear first as a wilt of leaves on one side of the plant. Eventually, the entire plant wilts, and infected plants usually die. Stalks appear dark brown or black at the ground level and look very much like black shank. However, bacterial wilt-infected plants have black streaks in the tissue just under the outer bark. Portions of lower stalk tissue will ooze milky strands of bacteria when placed in a clear container of water.

Bacterial wilt is a disease that is caused by a bacterium (*Ralstonia solanacearum*), which lives in the soil. These bacteria cause disease when they infect the roots through wounds. Any type of root wounding provides an entry point for infection. Therefore, shallow cultivation will help to avoid wounding roots, which provide points for infection. Natural wounds occur in the root system as a result of root growth through the soil; therefore, a certain amount of natural infection can take place, if the bacterial population is high enough in the soil around the root system.

The bacterium that causes bacterial wilt also infects a number of other crop plants, such as tomatoes, potatoes, peppers, eggplant and peanuts. Ragweed is a very common weed that is a host for the bacterium. Therefore, it is very important to recognize and control this weed thoroughly in areas planned for tobacco. The bacteria are very persistent in soil, and long rotations (three years or longer) may be necessary in some fields to assist in managing the disease. Rotation is imperative for management. Multipurpose chemicals (Telone C-17 and Chlor-O-Pic) also assist in control. Bacterial wilt **MUST** be managed by a combination of rotation, variety selection, and possible use of multipurpose chemicals. Other helpful practices include root and stalk destruction, enhanced soil drainage (utilize a high wide bed) and early shallow cultivation to avoid root wounding. It is also **VERY IMPORTANT** to avoid spread of bacterial wilt by movement of infested soil on farm equipment or by other means.

Mechanical Spread of Bacterial Wilt

Infection of tobacco in the field occurs typically through the root system. However, mechanical transmission of the bacterium during topping and harvesting also plays a significant role in the spread and severity of the disease.

BEST MANAGEMENT SYSTEM FOR CONTROL OF BACTERIAL WILT

The following points should be considered to help control bacterial wilt:

1. Crop rotation to include soybeans
2. Use of host resistance
3. Multipurpose soil fumigation
4. Hand topping or prioritize order of topping, and harvesting (**healthy tobacco first**). Consider using the redesigned topper blade which applies Clorox as a disinfectant.
5. Eliminate or reduce stalk wounding at harvest. Keep harvesters clean and properly adjusted to **avoid stem injury**
6. Use Roundup to kill stalks or immediate stalk destruction following last harvest
7. Maintain proper drainage in field
8. Use of a winter cover crop

MULTI-PURPOSE CHEMICALS FOR BACTERIAL WILT AND NEMATODE CONTROL.

MATERIAL	RATE/A	REMARKS	REI
Telone C17	10.5 gal	CAUTION: 3-week waiting period between Application and Transplanting.	5 days
Chlor-O-Pic	3.0 gal	Same as above.	48 hr and gas conc. less than 0.1 ppm
Remarks: Multi-purpose fumigants require waiting periods of up to 3 weeks before tobacco can be safely transplanted into fumigated soils. Good disease control by fumigation is possible whenever soil moisture and soil temperature conditions (55° F at 6 inches is best) are favorable. Cold, wet soils will not allow fumigants to work to the best of their capability. In-row multipurpose fumigation can be applied during the subsoiling operation. Placement of fumigant below the clay subsoil should be avoided. Soil moisture should not be excessive at the point of injection or poor control will be achieved.			

Black Shank Control

Black shank can cause significant losses in South Carolina tobacco. Black shank is caused by a fungus (*Phytophthora parasitica* var. *nicotianae*), which lives in the soil and attacks the plant primarily through the roots. Wounds are not required for infection by the black shank fungus. High soil moisture favors root colonization by the black shank fungus, although effects of early season infections become most apparent when soil moisture becomes limited. Sustaining high disease losses from black shank is tragic, because we know that rotation is very effective in reducing levels of the fungus in the soil. Any rotation is effective to some degree, because tobacco is the only host of the black shank fungus. The longer the rotation, the more effective the control. Therefore, rotation is the backbone of a successful control strategy, which also should utilize resistant varieties, chemicals and cultural practices.

FIELD INFESTATION LEVEL	ROTATION	VARIETAL RESISTANCE OPTIONS	CHEMICAL CONTROL
High (More than 6% disease)	1) 4 years	Moderate to high	Nematicide
	2) 3 years	High only	Multipurpose <u>or</u> Fungicide + Nematicide
	3) 2 years	High only	Fungicide + Nematicide
Moderate (1% - 6% disease)	1) 3 years	Low to High	Nematicide
	2) 2 years	High only	Multipurpose <u>or</u> Fungicide + Nematicide
	3) None*	High only	Fungicide + Nematicide
Low (Less than 1% disease)	1) 2 years	Low to high	Nematicide
	2) None*	High only	Multipurpose <u>or</u> Fungicide + Nematicide
<p>Remarks: Continuous culture (tobacco following tobacco) is not recommended. However, if this cropping system is chosen, use only varieties with high resistance and a black shank control chemical. Do NOT consider continuous culture if the infestation level is greater than 6% of the plants having black shank.</p> <p>Continuous use of new varieties with high resistance and the ph gene without crop rotation may lead to the development of new strains of the pathogen reducing the effectiveness of the newer resistant cultivars. Numerous fields have been observed with race 1 of black shank, which can cause disease on varieties with the ph gene. Producers should consider rotating tobacco varieties to include lines with and without the ph gene (see tobacco variety table in South Carolina Tobacco growers Guide). If race 1 occurs within your field (disease observed in a variety with the ph gene which imparts immunity to race 0) consider using a variety with high resistance that does not contain the ph gene. In addition, continuous use of new varieties with high resistance to black shank without crop rotation may lead to losses from other diseases such as fusarium wilt (see disease resistance ratings in SC Tobacco Growers Guide).</p> <p>Ridomil Gold and two new fungicides, Orondis Gold 200 and Presidio, are labelled for use on tobacco in 2017. Please see tables and information below for application recommendations, BUT ALWAYS CONSULT THE INDIVIDUAL PRODUCT LABEL FOR COMPLETE USE DIRECTIONS AND APPLICATION INFORMATION.</p>			

RIDOMIL GOLD FOR BLACK SHANK CONTROL

ROTATION	RIDOMIL GOLD SL APPLICATION	REI
None (Continuous tobacco is NOT recommended)	1 qt/A preplant broadcast <u>OR</u> 1 pt/A preplant broadcast + 1 pt /A layby* <u>OR</u> 1 pt/A preplant + 1 pt/A first cultivation + 1 pt/A layby*	48 hr
2 year (Tobacco in alternate years)	1.5 pt /A preplant broadcast <u>OR</u> 1 pt/A preplant broadcast + 0.5 pt /A layby*	48 hr
3 year or more (Tobacco every third year or more)	1 pt /A preplant <u>OR</u> 1 pt/A preplant broadcast + 0.5 pt/A layby*	48 hr
Remarks: *Apply Ridomil at layby cultivation using two drop nozzles per row directed to the sides of the bed. REI = reentry interval		

RIDOMIL GOLD FOR PRE-PLANT & POST-PLANT CONTROL OF BLACK SHANK

Application site	RIDOMIL GOLD SL APPLICATION	REI
Transplant water 24-C label or post-plant soil applications	Apply in transplant furrow while planting tobacco seedlings. Apply in 4-8 oz/A (0.25-0.5 pt/A) in at least 200 gallons of transplant water per acre. Additional soil applications (1st cultivation and/or layby) may be needed if disease pressure is high. <u>Do Not</u> Exceed label rate for the season. Consult label for potential of crop injury and application directions! 24-C Label should be in your possession at the time of application.	48 hr.

PRESIDIO FOR POST-PLANT CONTROL OF BLACK SHANK

Application Rates		Minimum Time from Last Application to Harvest (PHI)	Specific Use Instructions
fl oz/A	GPA Spray Mixture		
4 (0.125 lb ai/A)	Ground: Minimum 20	N/A	Post-transplant program: one application of <i>Presidio</i> fungicide can be made at either first cultivation or layby (last cultivation). Direct nozzles to cover soil beneath lower leaves incorporate immediately with cultivator.

*For best control of black shank with *Presidio* Fungicide, use with tobacco varieties that have moderate-to-high resistance to the black shank pathogen. Consult your local Cooperative Extension Service office or university specialist for information on variety selection.

ORONDIS GOLD 200 FOR PRE-PLANT & POST PLANT CONTROL OF BLACK SHANK

Rate (fl oz/A)	Application Timing
4.8 - 19.2	Apply at planting in furrow or in transplant water.
	Apply soil-directed or banded applications at 1st cultivation and layby.
Resistance Management:	
<ul style="list-style-type: none"> • Make no more than 2 sequential applications before rotating to a fungicide with a different mode of action. • Do not follow soil applications of Orondis Gold 200 with foliar applications of Orondis Opti A or Orondis Ultra A. 	
USE RESTRICTIONS	
<ol style="list-style-type: none"> 1) Maximum Single Application Rate: Do not exceed 19.2 fl oz per acre per application. 2) Maximum Annual Rate: Do not exceed 38.6 fl oz per acre per year. 3) Maximum Number of Applications: Do not make more than four applications per crop. 4) Minimum Application Interval: 7 days 5) Pre-harvest Interval (PHI): 7 days 	

ORONDIS + RIDOMIL GOLD CO-PACK FOR PRE-PLANT & POST PLANT CONTROL OF BLACK SHANK

Rate Orondis Gold 200 + Ridomil Gold SL	Use rate per 2 (ee) Recommendation
Maximum amount per season Orondis Gold 200 + Ridomil Gold SL	Do not exceed 38.6 fl. Oz. of Orondis Gold 200 soil use per acre per season Do not exceed the equivalent of 1.5 lbs. a.i. per acre of mefenoxam-containing products
Minimum gallons per acre (GPA)	Transplant (setter) water drench: 200 GPA 1 st Cultivation: 20 GPA Layby: 40 GPA
Preharvest Interval (PHI)	7 days
Adjuvants	Do not combine with adjuvants, surfactants or fertilizers, unless prior use has shown the combination physically compatible, effective and non-injurious under your conditions of use
Crop Rotation Intervals	0 days to crops on label 30 days to cereals and grass animal feeds 180 days to all other crops

Recommended Black Shank Fungicide Programs

The opportunity to use the Orondis Gold 200 + Ridomil Gold SL co-pack in a transplant-water application in 2017 offers new options for improved black shank control. Orondis Gold 200 needs to reach plant roots early to be effective, but when it does, it has shown excellent results in longer-term control. Its low water solubility also makes it less mobile in the soil, which is facilitated by application in the transplant water. The addition of Ridomil Gold in the co-pack also provides improved Pythium control. The following two program recommendations, **A & B**, take into consideration field sites with moderate or high history of disease. Because Ridomil Gold is water soluble, it may leach out of the root zone if a heavy rainfall event occurs after transplanting. In this case, consider an additional Ridomil application to maintain both black shank and Pythium control. Do not exceed label rate for the season, however.

Fungicide Program – Plan A
Two Applications – Moderate Disease Pressure

1. In Transplant Water
 - Orondis/Ridomil Co-Pack
2. At Layby
 - Ridomil Gold
 - Or
 - Presidio

Fungicide Program – Plan B
Three Applications – High Disease Pressure

1. In Transplant Water
 - Orondis/Ridomil Co-Pack
2. At 1st Cultivation
 - Presidio
3. At Layby
 - Ridomil

****Always Consult the Individual Product Label for Complete Use and Application Information***

Tomato Spotted Wilt Control

TSW infections occur through wounds in epidermal cells caused by tobacco thrips. Generally insecticides have been ineffective in reducing virus transmission because very little time is required to transmit the virus. The insecticide may kill the insect but only after the plant has already acquired the virus. Thrips population's peak in April and May and then decline in June. This approximates the timing of TSW seen in South Carolina.

The following points should be considered to help control Tomato Spotted Wilt:

1. Avoid early planting
2. Apply Admire (Imidacloprid) as a tray drench (refer to product label for application instructions)
3. Use healthy disease free seedlings to reduce stand loss to other pathogens
4. Follow fertility recommendations - avoid excessive nitrogen application
5. Irrigate if possible to assure sustained crop growth
6. Consider use of Actigard if expectation of disease loss is high or if severe losses to TSW were experienced in previous years (refer to product label for application instructions)

Target Spot Control

Target spot is endemic to South Carolina tobacco fields and is caused by a fungus (*Thanatephorus cucumeris*). Disease development is more severe during wet weather. The symptoms appear similar to brown spot and are easy to confuse. Necrotic tissue can become brittle, fall out, and leave a shot hole appearance. Under high relative humidity lesions can increase rapidly blighting large portions of the leaf.

FOLIAR TREATMENTS*	RATE	REMARKS
Quadris Flowable	6.0-12.0 oz/A	Apply on a 7-14-day interval with shorter intervals under conditions conducive to disease development. For ground application apply Quadris in sufficient water volume for adequate coverage and canopy penetration. Do not tank mix with Thiodan Quadris should be applied as a component in an Integrated Pest Management strategy . Check label for application information and potential crop injury. REI = 4 hours
Remarks: REI = reentry interval.		

Blue Mold Control

Blue mold occurs in Florida and Georgia almost every year and has the potential to cause severe losses in South Carolina. Ridomil resistant strains have been observed in other states and pose a possible threat to the tobacco crop in South Carolina. Blue mold is potentially one of the most destructive diseases of tobacco. It is caused by a fungus (*Peronospora tabacina*) that is airborne, and disease can spread very quickly, leading to epidemics if not properly managed. Acrobat has received a label for blue mold control but should be used in combination with another fungicide. Presidio received a label for blue mold control in 2015.

FIELD BLUE MOLD CONTROL

SOIL TREATMENTS	RATE	REMARKS
Ridomil Gold	0.5-1 pt/A	Broadcast and incorporate 2-4 inches at or before transplanting. An additional 0.5 pt/A may be used at layby if no more than 1 pt/A was applied at planting. REI = 48 hr.
FOLIAR TREATMENTS*	RATE	REMARKS
Forum (formerly Acrobat)	2-8 fl oz	Forum must be tank mixed with a product registered for control of blue mold, such as mancozeb, for resistance management. Neither Ridomil Gold nor Actigard are recommended as a tank-mix with Forum. Consult label before tank mixing with any product. Do not exceed 30 oz/season. REI = 0 days. Tobacco may be harvested the day of the last application, after the spray has dried.
Actigard 50 WG	0.5 oz/A	Begin application after plants reach a height of 12 inches. Apply on a preventative schedule when blue mold threatens. Another registered blue mold product should be used prior to 12 inches for early season control and after the final application if conditions are conducive for disease. Make up to 3 applications on a 10-day schedule. Apply in a minimum of 20 gals. /A. Application of Actigard may result in leaf yellowing. This cosmetic yellowing normally disappears after final application. REI = 12 hr.

FOLIAR TREATMENTS*	RATE	REMARKS
Quadris Flowable	6.0-12.0 OZ/A	<p>Quadris application should begin prior to disease development or at first indication that blue mold is in the area. Do Not apply Quadris as a curative application. If blue mold is present in the field, initiate application with Acrobat MZ prior to Quadris application. Apply on a 7-14-day interval with shorter intervals under conditions conducive to disease development. For ground application apply Quadris in sufficient water volume for adequate coverage and canopy penetration. Do not tank mix with Thiodan. Check label for potential crop injury.</p> <p>REI = 4 HOURS</p>
Presidio	4 (0.125) lb ai/A	<p>For resistance management, Presidio Fungicide must be tank mixed with a labeled rate of another fungicide active against the target pathogen, but with a different mode of action. Apply as a foliar spray prior to disease onset or at first indication that blue mold is in the area. A second foliar application may be made, with a minimum treatment interval of 7 days between foliar applications. Make no more than 2 foliar applications per season.</p> <p>REI = 12 hours</p>
Orondis Ultra A	2.0 – 4.8 oz/A	<p>Begin applications prior to disease development and continue on a 7- to 10-day interval.</p> <p>Use the higher rates when disease is present, for longer application intervals, or for susceptible varieties.</p> <p>For conventional ground application, apply at least 15 gallons per acre, increasing the spray volume as the plants mature to ensure thorough coverage of the foliage.</p> <p>For air-assisted ground application, apply at least 10 gallons per acre.</p> <p>For aerial application, apply at least 2 gallons per acre.</p> <p>Maximum Single Application Rate: Do not exceed 4.8 fl oz per acre per application.</p> <p>Maximum Annual Rate: Do not exceed 19.2 fl oz per acre per year.</p> <p>Maximum Number of Applications: Do not exceed six foliar applications per acre per year for the same crop.</p> <p>Do not use for more than 33% of the total foliar fungicide applications.</p> <p>Minimum Application Interval: 7 days</p> <p>Pre-harvest Interval (PHI): 7 days</p> <p>Resistance Management:</p> <p>Make no more that 2 sequential applications before rotating to a fungicide with a different mode of action.</p> <p>Do not follow soil applications of Orondis with foliar applications of Orondis Ultra A. Use either soil applications or foliar applications but not both for disease control.</p>

REI = reentry interval

TOBACCO GREENHOUSE DISEASE CONTROL

There are several potentially important disease problems that may occur in greenhouse transplant production systems. These include target spot (*Rhizoctonia solani*), white mold or stem rot (*Sclerotinia spp.*), damping-off caused by *Pythium* spp. or *Rhizoctonia spp.*, blue mold (*Peronospora tabacina*), gray mold (*Botrytis cinerea*), soft rot (*Erwinia spp.*) and tobacco mosaic virus. The potential also exists for diseases most often associated with field-grown tobacco to occur and include bacterial wilt (*Ralstonia solanacearum*) and black shank (*Phytophthora parasitica var. nicotianae*).

It is imperative that producers take extra precautions to prevent pathogens from entering the greenhouse and to minimize environmental conditions within the greenhouse that might encourage disease development. Thus, ventilation, sanitation, monitoring, and use of good production practices are important disease management factors.

DISEASE	CHEMICAL	RATE/50 GAL WATER	REMARKS*
Target Spot Blue Mold	Quadris Flowable 24-C Label	6 oz/A or 0.14 oz (4 ml)/1000 ft ² in enough water for thorough coverage (recommended 5 gal/1000 ft ²)	Make only one application prior to transplanting. Follow up applications can be made in the field according to the Quadris federal label. Greenhouse 24-C Label should be in your possession at the time of application. REI = 4 hours
	Terramaster 4EC	1.4 oz/100 gal water	Do not apply as a drench or in irrigation water. Apply this product only to tobacco float-bed water. Consult the label for mixing directions. Crop injury can occur with improper mixing. Terramaster 4EC used as a preventative treatment before symptoms occur, mix 1.4 fl. oz of Terramaster /100 gal of water no sooner than three weeks after seeding. A sequential preventative application of 1.4 fl oz/100 gal of water can be made 3 weeks after the first application. Do not apply Terramaster 4EC later than 8 weeks after seeding. REI = 12 hr.
	Terramaster 4EC	1.4 oz/100 gal water	Terramaster 4EC used as a curative treatment when symptoms first appear, mix 1.4 fl oz of Terramaster /100 gal of water no sooner than three weeks after seeding and when leaves are at least 1 in. in diameter. If <i>Pythium</i> symptoms recur after the first application, a second application of 1-1.4 fl oz/100 gal of water can be made. Allow at least a 3-week interval between the first and second application. Do not apply Terramaster 4EC later than 8 weeks after seeding. No more than 2.8 fl. oz. of Terramaster 4EC /100 gal of water may be applied to each crop of transplants. REI = 12 hr.
Remarks: The potential for phytotoxicity exists when Dithane DF or Manzate Pro-stick fungicide is used on tobacco seedlings. To minimize potential for damage, 72 hours prior to large scale application, user should test for potential phytotoxicity by applying the fungicide to a small sample area growing under similar conditions. In general, injury is greater in greenhouse systems. Ridomil Gold, or Acrobat are not labeled for use in greenhouses, or floatbed plant production systems. REI = reentry interval.			

TOBACCO NEMATODE CONTROL

Damage caused by nematodes are difficult to estimate because damage to roots may not be apparent in above ground symptoms, yet significant reductions in yields can occur with moderate levels of nematodes. Nematodes may increase the incidence of other diseases such as black shank, bacterial wilt and Fusarium wilt. The reduced use of fumigants during wet springs always results in dramatic increases in nematode damage and demonstrates the importance of soil fumigation!

Good disease control by fumigation is possible whenever soil moisture and soil temperature conditions (55° F at 6 inches is best) are favorable. Cold, wet soils will not allow fumigants to work to the best of their capability. In-row fumigant nematicides should be applied during the subsoiling operation. **Placement of fumigant nematicides below the clay subsoil should be avoided.** Soil moisture should not be excessive **at the point of injection** or poor control will be achieved.

TOBACCO NEMATICIDES

NEMATICIDE	RATE/A	ROOT KNOT CONTROL		REMARKS*
		Southern (<i>M. incognita</i>)	Peanut (<i>M. arenaria</i>)	
FUMIGANTS:				
Telone II	6 gal	Excellent	Excellent	FR REI = 5 days
Telone II	8 gal	Excellent	Excellent	FB REI = 5 days
MULTIPURPOSE CHEMICALS: **				
Telone C17	10.5 gal	Excellent	Excellent	FR REI = 5 days
Telone C17	12 gal	Excellent	Excellent	FB REI = 5 days
Chlor-O-Pic	3 gal	Excellent	Very Good ¹ Very Good ¹	FR REI = 48 hr and gas conc. less than 0.1 ppm
NONFUMIGANTS:				
Mocap 15 G	40 lb	Good	***	B & I REI = 48 hr
Remarks: * FR - Fumigant row; FB – Fumigant broadcast – place application chisels on 12 in centers; B & I - Broadcast and incorporate. ** Multipurpose chemicals have effectiveness for nematodes, and bacterial wilt. *** Not registered for this nematode species. ¹ Although some root galling may occur at the end of the growing season, yield responses are similar among the multipurpose fumigants. REI = reentry interval.				

AQUATIC WEED CONTROL

Cory Heaton, State Wildlife Specialist

Aquatic weeds in ponds or lakes can be controlled by physical removal, biological control, or herbicides. The method or combination of methods used will depend on factors such as target weeds, non-target plants, and what the water is used for. Physical removal can be accomplished manually or with machinery. It is time consuming, expensive and normally used alone if other methods are not feasible. However, a certain amount of physical removal may be necessary in combination with the use of biological control and herbicides. Prior to initiating any control measures, it is crucial to accurately identify species to be controlled. Herbicides and biological control agents are not equally effective on all species. Numerous websites and mobile apps can aid in species identification. You can also submit aquatic plant species to Clemson University's Plant Problem Clinic through your local extension office for identification.

Biological control is an option for certain aquatic weeds. The major advantages are ease of application and no concern over damage to plants irrigated with treated water. Triploid grass carp can control many submerged vascular aquatic weeds. Grass carp are usually used to control all vegetation in a pond, rather than selectively controlling certain vegetation. Replacement stocking of grass carp is necessary when fish are lost. A permit is required to stock grass carp, and only triploid fish can be legally used in SC. Tilapia are stocked in the spring and control most algae species. The concern with tilapia is that they are tropical animals and usually die during cold winters thereby requiring an annual stocking. Tilapia are legal for use in SC. The South Carolina Department of Natural Resources (SC DNR) now requires a free of charge permit prior to stocking tilapia and triploid grass carp for aquatic weed control in SC. A permit can be obtained from SC DNR at 803-734-3891 or from registered dealers in SC. The short permit can be faxed (803-734-4748) for a rapid turn-around. Check with your Department of Natural Resources to determine if grass carp and tilapia are legal to stock and if a permit is required in your state.

Diquat, endothall, glyphosate, flumioxazin, fluridone, triclopyr, copper, sodium carbonate peroxyhydrate, 2,4-D, carfentrazone, bispyribac, imazapyr, penoxsulam, topramezone, and imazamox compounds can be used safely in ponds used as irrigation sources if the manufacturer's label directions are followed. Certain waiting periods may be required before using water for irrigation after the herbicide is applied, while in some cases waiting periods are not required. Various chemicals have different product formulations; only aquatic labeled pesticides and surfactants/adjuvants may be used in aquatic applications, by law.

Effective October 2011, aquatic pesticide applications in SC require a permit from South Carolina Department of Health and Environmental Control (SCDHEC). These permits are issued in accordance with the federal Clean Water Act and the National Pollution Discharge Elimination System (NPDES). Aquatic pesticide applicators may be required to submit a Notice of Intent (NOI), practice Integrated Pest Management (IPM), and develop a Pesticide Discharge Management Plan (PDMP) in addition to the basic permit requirements. The additional requirements are based on established application thresholds. The threshold for an aquatic weed control application is 200 acres' treatment area or 20 miles of treated shoreline. Applicators below these levels are automatically covered by the SC general permit. Applicators above these levels will be required to submit a NOI, practice IPM, and possibly develop PDMP.

For more information on the NPDES permit please contact SCDHEC at (803) 898-4157 or online at http://www.scdhec.gov/environment/water/npdes_pesticide.htm.

Products for Use “To Waters Edge”

Aquatic applications in South Carolina do not always require products with full aquatic labels. In many instances, shoreline applications are made that do not involve product application directly into waters. Applications near but not into an aquatic environment can be made using products labeled for use “to waters edge”. Products to be utilized for such applications must be labeled accordingly. While many of the products labeled for this use have terrestrial labels, not all terrestrial labeled products are labeled for use along the water’s edge. It is the applicators responsibility select and only use products labeled specifically for this purpose.

Milestone Specialty Herbicide from Corteva is an example of a product labeled for use to waters edge. The Milestone label states “It is permissible to treat non-irrigation ditch banks, seasonally dry wetlands and transitional areas between upland and lowland sites only when dry. Milestone can be used to the waters edge. Do not apply directly to water and take precautions to minimize overspray to open water when targeting vegetation in and around non-flowing, quiescent or transient water....”. Label wording is not identical for every product. Always read the most current product label and only use products in accordance with the label.

Amount of Formulation for Application

Herbicide	Rate*
Aquathol	0.3 to 2.6 gal/acre foot of 4.2 L or 13 to 108 lb of 10G/acre foot or 2.2 to 22.0 lb of 63G/acre foot.
Hydrothol	0.3 to 3.4 gal/acre foot of 2L or 11 to 136 lb of 11G/acre foot.
Diquat	1 to 2 gal/surface acre of 2L.
2,4-D	1 to 2 gal/surface acre of 3.8 L or 150 to 200 lb of 20G/surface acre.
Copper Compounds	0.6 to 3.4 gal of Chelated Copper/acre foot or 0.1 to 0.5 ppm elemental copper.
Florpyrauxifen	1.35 to 6.75 fl oz/acre foot of 2.5SC or 3 to 75 fl oz/acre foot of 0.21EC
Fluridone	0.25 to 0.5 gal/surface acre. Check with company rep for exact rates.
Glyphosate	0.75 to 1.5% solution, depending on the weed species, using hand held application equipment
Triclopyr	2 to 8 quarts per surface acre of 3L.
Tompramezone	4.0-16.0 fl. oz. per acre for surface applications. 30-50 ppb for water treatment
Sodium Carbonate Peroxyhydrate	3 to 170 pounds per acre-foot of 50G.
Imazapyr	2 to 6 pints per acre.
Carfentrazone	3.4 to 13.5 fl. oz. per surface acre for floating vegetation - 0.286 gal/acre foot for submerged vegetation.
Penoxsulam	10 to 150 ppb; Not to exceed 150 ppb per growing season. Follow label for specific rates.
Imazamox	32 to 64 fl. oz. per surface acre broadcast foliar application. 50 to 500 ppb in water treatment
Flumioxazin	6-12 oz. per surface acre for surface applications. 100-400 ppb in water treatment or subsurface applications
Bispyribac	1-2 oz. per acre for surface applications. 20-45 ppb for water treatment or subsurface applications

***Acres foot** = 1 surface acre of water (43,560 ft²) 1 foot deep.

Effectiveness of Herbicides for Aquatic Weed Control

Weed	Copper complexes (Copper sulfate)	2,4-D	Diquat (Reward)	Endothol Aquathol K & G	Endothol Hydrothol G & 191	Florpyrauxifen	Fluridone	Glyphosate	Sodium Carbonate Peroxyhydrate	Trichlopyr	Imazapyr	Carfentrazone	Penoxsulam	Imazamox	Flumioxazin	Bispyribac	Tompramezone
Algae																	
Filamentous	E	P	P	-	G	-	P	P	F	-	-	-	-	-	E	-	-
Planktonic	E	P	G	-	G	-	P	P	E	-	-	-	-	-	P	-	-
Branched (Chara)	E	P	G	-	G	-	P	P	P	-	-	-	-	-	F	P	-
Nitella	E	P	G	-	G	-	P	P	P	-	-	-	-	-	F	P	-
Floating plants																	
Bladderwort	P	P	E	-	-	-	E	-	P	-	-	-	-	G	-	-	F
Duckweeds	P	G ¹	G	P	P	-	E	P	P	-	E	E	E	-	E	-	-
Floating heart	-	-	-	-	-	E	-	-	-	-	-	-	-	-	-	-	-
Mosquito fern	-	-	-	-	-	E	-	-	-	-	-	-	-	-	-	-	-
Water hyacinth	P	E	E	-	-	E	P	G	P	E	E	E	E	E	P	E	G
Watermeal	P	P	P	-	-	-	G	P	P	-	-	G	G	-	E	F	-
Submersed plants																	
Broadleaf watermilfoil	P	-	E	E	E	E	E	P	P	E	-	G	E	-	G	G	F
Coontail	P	G	E	E	E	G	E	P	P	-	-	-	-	-	G	P	-
Egeria	P	P	G	F	F	-	E	P	P	-	-	-	E	-	-	-	-
Elodea	P	-	E	F	F	-	E	P	P	-	-	-	E	-	E	-	-
Eurasian millfoil	P	E	E	E	E	-	E	P	P	E	-	E	E	F	G	G	-
Fanwort	P	F	G	E	E	-	E	P	P	-	-	-	-	-	G	-	-
Hydrilla	F ²	P	G	G	G	G	E	P	P	-	-	-	E	F	G	E	G
Naiads	P	F	E	E	E	-	E	P	P	-	-	-	G	-	E	-	F
Parrotfeather	P	E	E	E	E	G	-	F	P	F	E	E	G	G	G	-	-
Pondweeds (Potamogeton)	P	P	G	E	E	-	E	P	P	-	-	-	E	G	G	G	G

E=excellent control (90 to 100%); G=good control (80 to 89%); F=fair control (70 to 79%); P=poor control (<70%). A blank space (-) indicates weed response is not known.

¹Ester formulations only.

²Copper complex only

Effectiveness of Herbicides for Aquatic Weed Control - Continued

Weed	Copper complexes (Copper sulfate)	2,4-D	Diquat (Reward)	Endothol Aquathol K & G	Endothol Hydrothol G & 191	Florpyrauxifen	Fluridone	Glyphosate	Sodium, Carbonate Peroxyhydrate	Trichlopyr	Imazapyr	Carfentrazone	Penoxsulam	Imazamox	Flumioxazin	Bispyribac	Tompramezone
Emergent plants																	
Alders	P	E	F	P	P	-	P	E	P	-	-	-	-	-	-	-	-
Alligatorweed	P	F	P	P	P	E	G	E	P	E	E	G	G	G	G	E	-
American lotus	P	E	P	P	P	E	F	G	P	E	E	-	-	F	-	-	F
Arrowhead	P	E	G	G	G	-	-	E	P	-	E	-	G	-	G	E	G
Buttonbush	P	E	F	P	P	-	P	G	P	-	E	-	-	-	G	-	-
Cattails	P	G	G	P	P	-	F	E	P	-	E	-	-	E	P	-	-
Common reed	P	P	P	P	P	-	P	G	P	-	E	-	-	FG	P	-	-
Fragrant & white waterlily	P	E	P	P	P	-	E	E	P	E	E	-	-	G	F	F	-
Frogbit	P	E	E	-	-	-	-	-	P	E	E	-	-	E	G	E	-
Grasses, most	P	P	P	P	P	-	P	G	P	-	E	-	-	F	-	-	-
Maidencane	P	P	F	-	-	-	F	E	P	-	E	-	-	-	-	-	-
Pickerelweed	P	G	G	-	-	-	P	F	P	E	E	-	G	E	-	F	-
Pond-edge annuals	P	-	G	-	-	-	E	E	P	-	E	-	-	-	-	-	-
Rush	P	P	F	P	P	-	F	E	P	-	E	-	-	-	-	-	-
Sedges and rushes	P	F	F	P	P	-	P	G	P	-	E	-	-	-	P	F	-
Slender spikerush	P	-	G	-	-	-	G	P	P	-	-	-	G	F	-	-	-
Smartweed	P	E	F	-	-	-	F	E	P	E	E	-	G	G	P	G	F
Spatterdock	P	E	P	P	P	-	E	G-E	P	E	E	-	-	G	-	-	-
Southern watergrass	P	P	-	-	-	-	G	E	P	-	-	-	-	-	-	-	-
Torpedograss	P	P	P	-	-	-	F	G	P	-	E	-	-	-	-	-	F
Watershield	P	E	P	-	-	E	G	G	P	-	-	-	-	G	G	-	-
Water pennywort	P	G	G	P	P	E	P	G	P	E	E	-	E	E	G	G	-
Water primrose	P	E	F	-	-	E	F	E	P	E	E	G	-	F	G	-	-
Willows	P	E	F	P	P	-	P	E	P	-	E	-	-	-	-	P	-

E=excellent control (90 to 100%); G=good control (80 to 89%); F=fair control (70 to 79%); P=poor control (<70%). A blank space (-) indicates weed response is not known.

¹Ester formulations only.

²Copper complex only

Waiting Period (Days) Before Using Water After Application of Herbicides for Aquatic Weed Control

Common Name	Trade Name	Irrigation	Fish Consumption	Watering Livestock	Swimming
Copper	Crystalline copper sulfate and various liquid organic copper complexes	NR ¹	NR	NR	NR
2,4-D	Various formulations and manufacturers ²	Water use restrictions vary by formulation and manufacturer. Certain labels allow irrigation if an approved chemical assay has reached acceptable levels. A few labels allow irrigation with specific waiting periods. Certain labels may allow irrigation on established turf, immediately. CHECK INDIVIDUAL LABEL.			
Diquat	Reward	1 to 3 ³	NR	1	NR
	Weedtrine D	5	NR	5	NR
Endothal	Aquathol K	7 to 25	NR	7 to 25	NR
	Aquathol granular	7 to 25	NR	7 to 25	NR
	Aquathol Super K	7 to 25	NR	7 to 25	NR
	Hydrothol 191	7 to 25	NR	7 to 25	NR
	Hydrothol 191 granular	7 to 25	NR	7 to 25	NR
Florpyrauxifen	ProcellaCOR	0.5-35	NR	NR	NR
Fluridone	Avast, Sonar AS, Sonar SRP, Sonar PR, Sonar Q	7-30+	NR	NR	NR
Glyphosate	Rodeo, AquaNeat, AquaMaster, AquaPro	NR	NR	NR	NR
Sodium Carbonate Peroxyhydrate	Green Clean, Pak 27, Phycomycin	NR	NR	NR	NR
Triclopyr	Renovate	120 ⁴		NR ⁵	NR
Imazapyr	Habitat	120	NR	NR	NR
Carfentrazone	Stingray	0-14 ⁶	NR	0 to 1	NR
Penoxsulam	Galleon	<30 ppb Turf <1 ppb Others	NR	NR	NR
Imazamox	Clearcast	See note 7	NR	NR	NR
Flumioxazin	Clipper	5 days	NR	NR	NR
Bispyribac	Tradewind	< 1 ppb	NR	< 1 ppb	NR
Tompramezone	Oasis	< 1 ppb	0	0	0

¹NR = No restrictions.

²Most formulations do not permit application to ponds used for irrigation or for watering dairy cattle.

³Three days for irrigation of turf and nonfood crops; five days for irrigation of food crops (including tobacco) or for preparation of agricultural sprays.

⁴No restriction for established grasses and assay to reduce restriction time.

⁵14-day restriction on grazing site and growing. Season grazing restriction on lactating livestock after irrigating pasture.

⁶1 day if <20% of surface acreage is treated. 14 days if >than 20% is treated. Certified lab test of <5 ppb.

⁷ DO NOT use treated water for greenhouses, nurseries or hydroponics – bioassay for canola, onions, potatoes or sugar beets; other crops 1 day

Common Aquatic

Plants Consumed by Grass Carp¹

Plants in order of common name preference

hydrilla 1	hygrophila 9	maidencane ² (<i>Panicum</i>) 16
chara (muskgrass) 2	cattail ² 10	parrot feather 16
pondweeds (<i>Potamogetan</i>) 3	torpedograss 10	know grass (<i>Paspalum</i>) 17
bushy pondweed (Southern naiad) 4	salvinia 10	water hyacinth 17
elodea 5	water-aloe (<i>Stratiotes</i>) 11	giant bulrush ² 18
watermeal 6	watercress 12	water lettuce 18
duckweeds 7	torpedograss 13	soft-stem bulrush ² 19
water-fern (<i>Azolla</i>) 7	Eurasian watermilfoil 14	
coontail 8	eel grass (<i>Vallisneria</i>) 15	

¹ Adapted from “Grass Carp - A Fish for Biological Management of Hydrilla and Other Aquatic Weeds in Florida” by David L. Sutton and Vernon V. Vandiver, Jr., University of Florida IFAS, Bulletin 867; and from “Managing Aquatic Vegetation With Grass Carp - A Guide For Water Resource Managers” edited by John R. Cassani, American Fisheries Society, Bethesda, Maryland.

²Young, succulent, underwater shoots are preferred. Some plants have the same number, which means grass carp like them equally

Aquatic Plant Management Internet References

AQUAPLANT – A Pond Manager Diagnostic Tool – Texas AgriLife Extension Service, Texas A&M University
<http://aquaplant.tamu.edu/>

Aquatic Plant Control Research Program – U.S. Army Corps of Engineers <http://el.erdc.usace.army.mil/aqua/>

Aquatic Plant Information System
<http://el.erdc.usace.army.mil/aqua/apis/apishelp.htm>

Center for Aquatic and Invasive Plants – University of Florida, IFAS
<http://plants.ifas.ufl.edu/>

South Carolina Department of Health and Environmental Control – NPDES Permitting
http://www.scdhec.gov/environment/water/npdes_pesticide.htm

South Carolina Department of Natural Resources – Commercial Aquatic Pesticide Applicators
www.dnr.sc.gov/wildlife/publications/pdf/LakeMgtConsultants.pdf

Aquatic Plant Management Mobile Apps

AQUAPLANT – A Pond Manager Diagnostic Tool – Texas AgriLife Extension Service, Texas A&M University
<http://aquaplant.tamu.edu/useful-apps/>

AQUACIDE – Aquatic Herbicide Selection, Effectiveness, and Restriction Guide – Texas AgriLife Extension Service, Texas A&M University
<http://aquaplant.tamu.edu/useful-apps/>

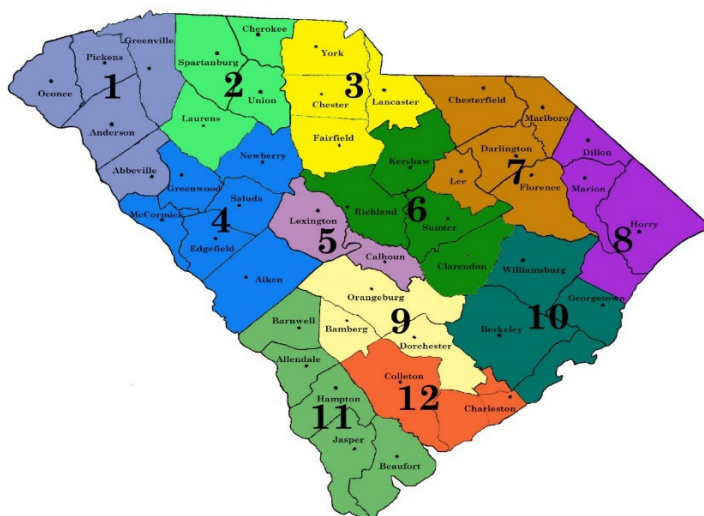
PONDALC – Pond Size and Volume Calculator – Texas AgriLife Extension Service, Texas A&M University
<http://aquaplant.tamu.edu/useful-apps/>

Aquatic Plants – Aquatic Plant Identification Tool – NC State University
<http://www.weedscience.ncsu.edu/aquaticweeds>

DEPARTMENT OF PESTICIDE REGULATION

<https://www.clemson.edu/public/regulatory/pesticide-regulation/>

The Department of Pesticide Regulation (DPR) is the South Carolina regulatory and investigative agency for pesticides. The DPR enforces the South Carolina Pesticide Control Act (SCPCA), the South Carolina Chemigation Act (SCCA), the state groundwater plan, as well as the Federal Pesticide Recordkeeping Requirement and the EPA's Worker Protection Standard (WPS) and the Fish & Wildlife Service's Endangered Species Program. The DPR also registers pesticides for South Carolina, licenses pesticide applicators and pesticide dealers, and performs quality assurance analysis of pesticide formulations



Regulatory Inspectors Territory Map:

Territory 1	Territory 2	Territory 3
Donell Glover 864.646.2174 donellg@clemson.edu	Ernie Schoonover 864.245.2488 ernesti@clemson.edu	Abe Green 803.628.0303 ionieg@clemson.edu
Territory 4	Territory 5	Territory 6
Dan James 803.403.7262 wjdjames@clemson.edu	Leslie Godfrey Field Supervisor 803.736.7680 x.112 lgdfry@clemson.edu	Roger Lind 803.736.7680 x.116 rlind@clemson.edu
Territory 7	Territory 8	Territory 9
Michael Tucker 843.667.1393 mt6@clemson.edu	Diana Canaday ¹ 843.957.1727 dcanada@clemson.edu	Michael Russell 843.225.7063 russel4@clemson.edu Matthew Rogers ² 864.655.5034 rogers4@clemson.edu
Territory 10	Territory 11	Territory 12
Cecil Hernandez ³ Field Supervisor 843.225.7062 chrnndz@clemson.edu Vacant 864.646.2150	Kristin Lenox-Rustin 843.696.5839 klenox@clemson.edu	Kevin DeLorenzo ⁴ Structural Program Manager 843.225.7065 kdelore@clemson.edu

¹Georgetown - northern half, North of Winyah Bay across to North of Andrews; ²Structural Compliance Inspections ³Charleston - eastern half East of Cooper River, Georgetown - southern half to Hwy 17 bridge across to Andrews; ⁴Downtown Charleston, North Charleston, West Ashley including all the sea islands down to and including Edisto.

Disclaimer

The mention of a pesticide product is not an endorsement nor discrimination against any other product by Clemson University Cooperative Extension Service. Pesticide products not mentioned here may also be efficacious and their absence from these recommendations does not necessarily mean that they are not also effective pest management tools. These recommendations are not meant to be an exhaustive recommendation, and associated comments, given here are in all cases are superseded by the pesticide product labels.

It is your responsibility as a pesticide user to read and follow the instructions on the product label in deciding your pesticide purchases and in their use, including mix/loading of the product, application, clean-up, and the disposal of unwanted product, rinsates, and clean empty product containers. **Remember: The Label is the Law.** For further assistance, please contact your local county Extension office.

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College of Agriculture, Forestry, and Life Sciences