

# 2016 Mid-South Cotton Defoliation Guide

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**Defoliation** is the shedding of cotton leaves that naturally occurs when leaves become physiologically mature. Leaf shedding (abscission) results from activity of special cells at the base of the leaf petiole where it joins the stem. This area is called the "abscission layer." Defoliation may be induced by a light frost, insect damage, disease, drought or mineral deficiency. It can also be artificially achieved by the use of certain chemicals called "defoliant" or harvest aids. In situations where canopies are dense and there are significant numbers of green bolls that need to be opened, two applications are often required. Planning a two-pass approach, especially in lush, irrigated cotton as opposed to getting less than desirable results such as stuck leaves or poor defoliation from a single application attempt is recommended. The goal of the first application is to remove as much foliage as possible exposing the unopened bolls without causing desiccation. The second harvest aid application will require additional defoliant to finish removing lower canopy leaves but, more importantly, an adequate boll opener to stimulate boll opening.

**Desiccation** is drying of plant tissues due to disruption of cell membranes and rapid loss of moisture which often results in "stuck leaves." Product selection and application rates should be adjusted to match environmental conditions as they change during the harvest season in order to reduce occurrence of leaf desiccation.

#### **What are the benefits from defoliation?**

- Removing leaves
- Eliminating the main source of stain and trash
- Better lint grades
- Preventing boll rot
- Faster and more efficient picker operation
- Managing maturity, allowing earlier harvest
- Increased air movement through the crop canopy which facilitates quicker drying, thus allowing picker to begin earlier in the day
- Reducing moisture
- Improving storage in modules

#### **Application Timing and Conditions**

**Weather** – Weather conditions at the time of application and three to five days following application have a significant effect on cotton response to harvest aids. Harvest aids are most active when temperature, sunlight intensity and relative humidity are high. Nighttime temperatures above 60 F are especially important with regard to activity of certain harvest aids. At temperatures above 60 F, the rate of leaf drop roughly doubles for each 10-

degree rise in temperature. At least one full day of clear weather following application is needed for best results.

**Plant Conditions** – Optimum defoliation is achieved in mature, well-fruited, uniform plants that have 'cutout' but are not completely inactive. Plant nutrient supply, particularly nitrogen, should be almost exhausted, and the crop should not be under drought stress. Poor defoliation may result when defoliant are applied to drought-stressed crops which may have leaves with thick cuticles.

**Application Timing** – There are many ways to determine proper defoliation timing, but the following have proven to be effective:

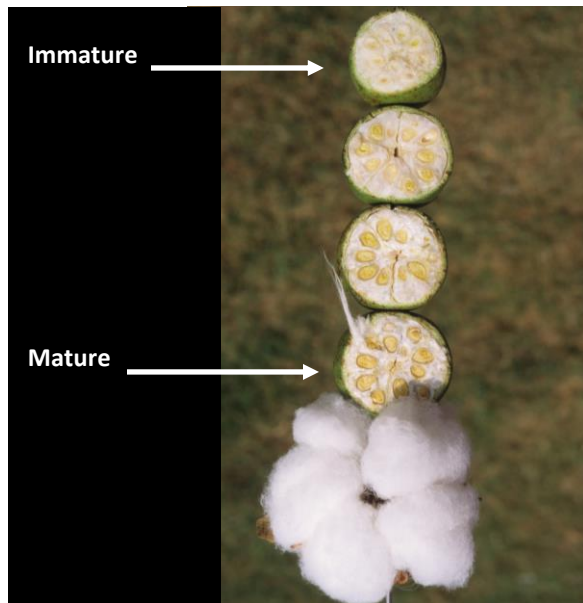
**NAWF 5 + 850 DD60's:** Using heat unit accumulation after NAWF (node above white flower) 5 has some merit when determining defoliation timing. Calculating DD60's after "cutout" which is defined as the point where the cotton reaches NAWF=5 is a good way to gauge crop maturity; however, this method should be used in combination with other techniques. This method is nearly always the first to recommend defoliation and can sometimes trigger defoliation applications too early. DD60 accumulation after NAWF=5 should always be accompanied by determination of percent open bolls and visual inspection to ensure that premature defoliation does not occur. Early defoliation can reduce micronaire and has also been shown to reduce yield in some situations. One must first weigh the benefits of decreased micronaire vs. the potential yield loss from early defoliation.

**Percent Open Boll:** Measuring percent open boll has been the standard defoliation technique for many years and is still the "old standby". It is generally safe to defoliate when 60 percent of the bolls are open. However, this strategy may not work well in situations where fruit has been set over a varying period of time due to plant stresses such as insect damage. In some situations, defoliation at 60 percent open may be premature and cut short the development of bolls in the upper canopy, thereby reducing yield and micronaire. On the other hand, a crop set in a short period of time could be safely defoliated at 40 to 50 percent open boll. Many producers tend to under estimate percent open boll and may actually be waiting until 70-80 percent open to defoliate. Estimating percent open boll from the truck will generally underestimate percent open bolls. To accurately determine percent open bolls measure 3 feet of row in 10 places in the field and

actually count open and closed bolls and calculate the percent that are open.

**Node Above Cracked Boll (NACB):** To use the NACB method, find the uppermost first position cracked boll and count upwards on the plant to the uppermost harvestable boll. Once NACB has been determined, cut the uppermost harvestable boll with a sharp knife to inspect the lint and seed. If the boll is mature, then defoliation is safe. A NACB of 4 is generally safe for defoliation. If the uppermost harvestable boll is immature, wait until NACB of 3. In addition, low plant populations (less than two plants per foot of row) may require a NACB count of 3 to be safe. Low plant populations result in a less evenly distributed fruit load with high numbers of bolls set on vegetative branches and outer positions of fruiting branches.

**Sharp Knife Technique:** The sharp knife technique should be used to validate all methods of defoliation timing. Choose the uppermost boll that has a chance of contributing yield and make a cross section of the boll with a sharp knife. Generally this boll will be located 4 to 5 nodes below the terminal depending on end of season stresses. Bolls are mature and when they are difficult to cut and a cross section of the seed reveals folded cotyledons, absence of jelly and darkened seed coats.



**Hal Lewis Method:** The Hal Lewis Method of timing defoliation has gained momentum over the last several years and has shown promise in predicting end of season micronaire. The system uses a

representative sample of the bottom four first position bolls and compares the micronaire to a chart which predicts whole field micronaire. If whole field micronaire is predicted to be in the discount range, defoliation prior to 60-70 percent open is recommended. The technique may save a producer from discounts while maintaining yields.

Regardless of which method you prefer, a combination of techniques should always be used. All growers are urged to walk as many of their fields as possible and determine the overall maturity of their crop. Rarely do all portions of a field mature at the same time. Therefore, the risks of defoliating too early or late can be reduced by using a combination of the aforementioned techniques.

#### **Application**

Most harvest aid materials do not translocate or move very far within the plant. Therefore, application coverage is important. Hollow cone nozzles are superior to air-induction nozzles as they improve foliar coverage using ground application equipment. Two equally spaced hollow cone nozzles per row will give adequate coverage. Spray pressure, ground speed and nozzle size should be matched appropriately in order to apply the desired spray volume in accordance with label instructions. The amount of water used as a carrier in each defoliation application should not be lower than 5 gallons per acre for aerial applications and 15 gallons per acre by ground. A second application of defoliant may be required for defoliation of rank cotton. Consult the product label for rates and other pertinent information.

#### **Other factors to consider when defoliating:**

Do not defoliate all cotton at one time. Defoliant should be applied 10 to 14 days prior to anticipated harvest date. Leaf drop should start in about four days and be complete in about 10 days. Rain three to four hours after application of a defoliant does not lessen the effectiveness of most chemicals with the exception of thidiazuron, which requires a 24 hour rain-free period.

#### **Types of Defoliants:**

Defoliants can be categorized as having either herbicidal or hormonal activity. Folex, Aim, Display, ET, and Sharpen are herbicidal-type defoliants that injure the plant, causing it to produce ethylene in response to the injury. Ethylene

production promotes formation of an abscission layer and ultimately, leaf drop. Increased application rates of these materials during periods of warm temperatures may kill the leaf prior to ethylene synthesis. This results in desiccation or "leaf stick" instead of the desired defoliation (leaf drop).

Thidiazuron, Ginstar, Finish, and ethephon are hormonal defoliant that result in increased ethylene synthesis by the plant. Ethephon releases ethylene, which stimulates further ethylene synthesis in the plant, resulting in abscission zone activation in the boll walls and leaf petioles. Thidiazuron contains a hormone known as a cytokinin. Although cytokinins promote leaf health in most plant species, in cotton very high concentrations of cytokinins promote ethylene synthesis and act as a defoliant. Because these hormonal-type defoliant bypass herbicidal injury, they are not as likely to cause desiccation (leaf stick) as herbicidal defoliant.

### ***Herbicidal Defoliant:***

**Folex:** Phosphate-type materials containing tribufos (active ingredient in Folex) have been used for years and are regarded as standards. Their performance is essentially equal and effective over a broad range of environmental conditions. Minimum temperature for optimum performance is 55-60 F. These materials do not inhibit re-growth or appreciably improve boll opening. Activity improves with advanced maturity of the crop. Leaf removal with each of these products is usually rapid and addition of surfactants offers benefit only under adverse conditions. These products have a pungent odor.

**Labeled Rates: 16 — 24 oz per acre, lower rates may be utilized in tank-mixtures with other harvest aids.**

**Aim:** Aim (carfentrazone) has excellent activity for desiccation of juvenile growth, but does not inhibit re-growth. In mature cotton, and/or cool conditions, Aim activity is similar to Folex. However, in warm conditions less-than-desirable defoliation and excessive desiccation have been observed. When two applications are necessary, Aim has performed very well as the second application. Aim has shown excellent activity in desiccating morningglories. Aim can be tankmixed with any defoliant, and the addition of 1 percent v/v crop oil is needed.

**Labeled Rates: 0.25 — 1.6 oz per acre.**

**Display:** Display is a new cotton harvest aid that is a combination of the herbicides carfentrazone (Aim)

and fluthiacet-methyl (Cadet). Similar to other herbicidal defoliant, Display has excellent activity on juvenile leaves including re-growth. However, Display will not inhibit re-growth. Under warm conditions, less-than-desirable defoliation and excessive desiccation may be observed. In situations in which two applications are necessary, Display has performed very well when included in the second application. Display has shown excellent activity in desiccating morningglories. In situations with thick vines, Display alone or in combination with other defoliant will desiccate morningglories very well. Addition of 1 percent v/v crop oil concentrate or 0.25 percent v/v NIS is needed.

**Labeled Rates: 0.3 – 1.0 oz per acre**

**ET:** ET (pyraflufen ethyl) has excellent activity for desiccation of juvenile growth, but does not inhibit re-growth. In mature cotton, and/or cool conditions, ET activity has been shown to be similar to Folex. However, in warm conditions less-than-desirable defoliation and excessive desiccation is likely with ET. In situations in which two applications are necessary, ET has performed very well as the second application. ET can be tank-mixed with other defoliant, and the addition of 0.5-1.0 percent v/v crop oil is needed.

**Labeled Rates: 1.5 – 2.75 oz per acre.**

**Sharpen:** Sharpen (saflufenacil) is a newly released herbicidal defoliant/desiccant. Sharpen has excellent activity on mature and juvenile leaves including regrowth. Sharpen will provide little to no inhibition of re-growth. During periods of warm to hot temperatures, application of Sharpen may lead to excessive desiccation. However, in a two-pass defoliation scenario, Sharpen has performed very well in the second application. Sharpen must be applied with methylated seed oil (MSO) at 1 percent v/v plus ammonium sulfate (AMS) or urea ammonium nitrate (UAN)

**Labeled Rates: 1.0 to 2.0 oz per acre**

**Glyphosate (many formulations):** Glyphosate provides excellent re-growth inhibition of conventional (non-Roundup Ready Flex) cotton when applied in conjunction with defoliant or ethephon and helps control susceptible late-season weeds. Check specific product labels for registration as a harvest aid. Glyphosate will not enhance performance of harvest aids when applied to

Roundup Ready Flex or Glytol/Liberty Link cotton.

**Labeled Rates: 11 – 44 oz per acre Roundup WeatherMax or equivalent rate of alternative product for re-growth control in non-RR cotton.**

### ***Hormonal Defoliant and Boll Opening Materials:***

**Thidiazuron (many formulations):** Thidiazuron SC is formulated as a soluble concentrate, requires a 24-hour rain-free period, and is sensitive to cool weather. Thidiazuron should not be applied when the average 24-hour temperature is predicted to be below 65 F for two to three days after application. In addition, thidiazuron products are slower with regard to leaf removal than Folex and may leave some bottom leaves; however, they effectively remove juvenile foliage. Thidiazuron does not improve boll opening; however, it will strongly inhibit re-growth when applied under favorable weather conditions at appropriate use rates. The potential for leaf desiccation is reduced with thidiazuron compared to herbicidal defoliant, especially when applied during periods of high temperatures. If thidiazuron is applied under less-than-favorable conditions, the addition of crop oil concentrate may enhance the activity of these materials. It is important to follow suggested sprayer cleanout procedures with thidiazuron. **Labeled Rates: 1.6 – 6.4 oz/ac**

**Ginstar** Ginstar is an emulsifiable concentrate formulation of thidiazuron and diuron (Karmex, Direx). Ginstar should be applied to mature cotton at least five days prior to scheduled harvest; however, defoliation may take longer under cool conditions. Addition of adjuvants or excess Ginstar rates can cause desiccation or “stuck leaves” under warm conditions. The Ginstar label does not discuss tank-mixtures; however, tank-mixtures with ethephon have enhanced boll-opening activity.

**Labeled Rates: 6.4 – 16 oz per acre. Lower rates may be utilized during periods of extremely warm air temperatures or in tank-mixtures with other harvest aids**

**Finish 6 Pro:** Finish 6 Pro contains ethephon and the synergist cyclanilide which aids in defoliation. Finish 6 Pro is an excellent boll opener and may be as a stand-alone product in warmer temperatures and well-cutout situations. Finish 6 Pro exhibits a limited level of re-growth control and is generally a faster boll opener than ethephon. Finish 6 Pro can

be tank-mixed with thidiazuron, phosphate materials and Ginstar.

**Labeled Rates: 1.33 – 2.33 pints per acre.**

**Ethephon 6, BollBuster, etc.:** Ethephon is a boll opening material that also enhances defoliation when applied in combination with other harvest aids. Acceptable defoliation with ethephon alone usually requires mature leaves, warm weather, and high use rates. Ethephon does not help bolls mature, but helps open mature and immature bolls. The addition of thidiazuron is recommended in cases where re-growth is expected.

**Labeled Rates: 1.33 – 2.33 pints per acre.**

### ***Desiccants:***

**Paraquat (Gramoxone SL; Firestorm):** Paraquat can aid in opening of mature bolls when 3.1 to 5 oz/A is applied in combination with Folex, thidiazuron, or ethephon. Development of immature bolls will be inhibited by paraquat application. Paraquat is not recommended for use as a defoliant or boll opener for spindle picked cotton unless a freeze is imminent. Use higher rates for desiccation of weeds and for stripper-harvested cotton.

**Labeled Rates: 3.1 – 32 oz per acre.**

**Sodium Chlorate (Numerous Brands Available):** Higher rates of sodium chlorate may act as a desiccant, tending to stick leaves on the cotton plant. At normal use rates for defoliation, sodium chlorate is generally not as effective as the other defoliant. It is not a strong inhibitor of terminal growth. Do not mix the chlorates with phosphate defoliant, phosphate insecticides or Prep.

### ***Defoliating Drought-Stressed and Rank Cotton:***

Drought-stressed cotton often has thick cuticles and leathery leaves that inhibit the uptake of many defoliant. The potential for re-growth is often high due to unused nitrogen remaining after premature cutout. Uptake of dry formulations of thidiazuron appears to be slightly inhibited in drought-stressed cotton and higher rates and/or surfactants may be needed. Thidiazuron SC and Ginstar are liquid formulations and limited research suggests that their uptake may be less affected by drought-stressed cotton than dry formulations of thidiazuron. Tank-mixtures with Folex, as well as the addition of silicone surfactants or ammonium sulfate, have been shown to increase the uptake of thidiazuron in drought-stressed cotton. However, use caution when



applying higher rates or adjuvants in warmer weather, as desiccation and stuck leaves may result.

Obtaining adequate spray coverage makes defoliation of rank cotton challenging. A common mistake is to increase rates in an effort to achieve better defoliation. Increased rates are likely to cause leaf desiccation at the top of the plant where most spray solution is intercepted. The best approach is to apply normal rates, and plan to make a second application. Rank cotton is generally more difficult to defoliate than normal cotton. However, if effective defoliation is achieved in the first application, the second application may not require high application rates of selected products or complex tank mixes. Additionally, a boll opener can be more effective if added to the second application due to increased coverage.

Addition of an approved adjuvant to hormonal type harvest aid materials such as thidiazuron may improve defoliation when applied to drought-stressed cotton or when 60 F to 65 F nighttime temperatures are expected. However, use of adjuvants with Ginstar is not recommended due to increased likelihood of leaf desiccation, especially during periods of high temperatures. In addition, during high temperature situations, combinations of herbicidal-type defoliant may desiccate leaves. Re-growth is often a problem if rainfall occurs following application. Re-growth can be a concern with applications of Folex alone or tank-mixed with ethephon, depending on moisture conditions and temperature following application. Activity of most defoliant is reduced under cooler conditions at which time higher application rates will be needed. Re-growth is generally not as big a concern during cooler weather compared to warmer weather. Boll openers should be added to all treatments to promote boll opening at least three but preferably five days in advance of freezing temperatures.

**Rotational Crop Restrictions:**

Producers who wish to follow a cotton crop with a small grain such as wheat should observe the following re-crop intervals to prevent crop injury or stand failure.

**Table 1.** Label restrictions for planting small grains following harvest aid application in cotton.

Harvest Aid	Small Grain Re-Crop Interval
Thidiazuron	14 days
Ginstar	1 month
Folex 6	None
Aim	None
Display	None
ET	None
Sharpen	None
Glyphosate	None
Finish 6 Pro	1 month
Ethephon	1 month
Paraquat	None
Sodium Chlorate	None

**Additional Questions:**

Additional questions regarding information contained within this guide may be directed to your local Extension Specialist.

**Disclaimer:**

Information contained within this publication is intended to serve a guide with regard to cotton defoliation. Many factors influence activity of harvest aid materials. Leaf desiccation and stuck leaves may result with any harvest aid application. Use this guide and previous experience when selecting harvest aid programs.



**Table 2.** Use pattern and expected activity for defoliant and desiccants.

Harvest Aid <sup>1</sup>	Labeled Broadcast Rate/Acre	Max. Use per Season	Rainfree Period (hours) <sup>2</sup>	Pre-Harvest Interval (Days)	Estimated min. temp.	Mature leaves	Juvenile growth	Re-growth prevention	Boll opening
Thidiazuron SC	1.6-6.4 oz	9.6 oz	24	5	65 F	Excellent	Excellent	Excellent	None
Ginstar	6.4-16 oz	16 oz	12	5	60 F	Excellent	Excellent	Excellent	None
Folex 6	16-24 oz	24 oz	1	7	60 F	Excellent	Fair	Poor	None
Aim	0.5-1.6 oz	3.2 oz	8	7	55 F	Excellent	Excellent	Poor	None
Display	1.0 oz	2 oz	8	7	55 F	Excellent	Excellent	Poor	None
ET	1.5-2.75 oz	5.5 oz	1	7	55 F	Excellent	Excellent	Poor	None
Sharpen	2.0 oz	2.0 oz	1	5	55 F	Excellent	Excellent	Poor	None
Ethephon	21-42 oz	42 oz	6	7	60 F	Fair	Poor	Poor	Excellent
Finish 6 Pro	21-42 oz	42 oz	6	7	60 F	Excellent	Poor	Fair	Excellent
Glyphosate <sup>3</sup>	11-44 oz	44 oz	4	7	55 F	Fair	Fair	Excellent	None
<b>Desiccants</b>									
Paraquat	3.1-32	32	30 min.	3	55 F	Fair	Excellent	Poor	Fair
Sodium Chlorate	4.5 # ai	N/A	24	7	55 F	Fair	Fair	Poor	None

<sup>1</sup> Addition of spray adjuvants may enhance defoliation during cold temperatures or when leaves are tough from drought-stressed conditions. However, adjuvants may increase leaf desiccation during the early season when temperatures are warm.

<sup>2</sup> Expected rainfree periods are estimates only and may or may not be exact. Other conditions, including temperature, moisture and crop status, will play a role in product performance.

<sup>3</sup> Non-glyphosate tolerant (Roundup Ready Flex; Glytol/Liberty Link) varieties only.

## Defoliation Program Selection Guide

Maximum Daytime Temperature Greater than 80 F

High Regrowth Potential

Boll Opening Needed

One-Pass Program ..... Category 1

Two-Pass Program ..... Category 2

Boll Opening Not Needed

One-Pass Program ..... Category 3

Two-Pass Program ..... Category 4

Low Regrowth Potential

Boll Opening Needed

One-Pass Program ..... Category 5

Two-Pass Program ..... Category 6

Boll Opening Not Needed

One-Pass Program ..... Category 7

Two-Pass Program ..... Category 8

Maximum Daytime Temperature Less than 80 F

Boll Opening Needed

One-Pass Program ..... Category 9

Two-Pass Program ..... Category 10

Boll Opening Not Needed

One-Pass Program ..... Category 11

Two-Pass Program ..... Category 12



# Defoliation Program Product Selection Guide

## Category 1 – Warm temperatures; high regrowth potential; boll opening needed; one-pass program

Thidiazuron 2 – 3 oz/A + ethephon 26 - 32 oz/A  
Thidiazuron 2 – 3 oz/A + Folex 6 EC 4.0 oz + ethephon 21 oz/A  
Thidiazuron 2 – 3 oz/A + Finish 6 Pro 21 oz/A

## Category 2 – Warm temperatures; high regrowth potential; boll opening needed; two-pass program

Thidiazuron 2 – 3 oz/A+ ethephon 8 – 16 oz/A fb Folex 6 EC 1.0 pt/A or Aim/Display/ET/Sharpen\* + ethephon 21 – 32 oz/A  
Thidiazuron 2 – 3 oz/A + Finish 6 Pro 21 oz/A fb Folex 6 EC 1.0 pt/A or Aim/Display/ET/Sharpen\* + ethephon 21 – 32 oz/A  
Thidiazuron 2.0 – 3.0 oz/A + Folex 4 – 6 oz/A fb Folex 6 EC 8 – 10 oz/A or Aim/Display/ET/Sharpen\* + ethephon 21 – 32 oz/A  
Folex 6 EC 12 oz/A + ethephon 21 oz/A or Finish 6 Pro 21 oz/A fb Aim/Display/ET/Sharpen\* + ethephon 21 oz/A  
Finish 6 Pro 1.5 – 2.0 pt/A fb Aim/Display/ET/Sharpen\* + ethephon 10 oz/A

## Category 3 – Warm temperatures; high regrowth potential; one-pass program; boll opening not required

Thidiazuron 3 – 4 oz/A + 0.25% NIS  
Thidiazuron 2 – 3 oz/A + Folex 6 EC 4 – 6 oz/A  
Ginstar 5 – 8 oz/A

## Category 4 – Warm temperatures; high regrowth potential; two-pass program; boll opening not required

Thidiazuron 3 – 4 oz/A + 0.25% NIS fb Folex 6 EC 1.0 pt/A or Aim/Display/ET/Sharpen \*  
Folex 6 EC 12 oz/A fb Aim/Display/ET/Sharpen\*  
Ginstar 5 – 8 oz/A fb Aim/Display/ET/Sharpen\*

## Category 5 – Warm temperatures; low regrowth potential; boll opening needed; one-pass program

Thidiazuron 1.6 oz/A + ethephon 21 – 32 oz/A  
Thidiazuron 1.6 oz/A + Folex 6 EC 4.0 oz/A + ethephon 21 – 32 oz/A  
Thidiazuron 1.6 oz/A + Finish 6 Pro 21 – 32 oz/A  
Folex 6 EC 6 – 12 oz/A + ethephon 21 – 32 oz/A  
Folex 6 EC 6 – 12 oz/A + Finish 6 Pro 21 – 32 oz/A

## Category 6 – Warm temperatures; low regrowth potential; boll opening needed; two-pass program

Thidiazuron 1.5 oz/A + Folex 6 EC 4.0 oz + ethephon 21 oz/A fb Folex 6 EC 1.0 pt/A or Aim/Display/ET/Sharpen + ethephon 21 – 32 oz/A\*  
Thidiazuron 1.5 oz/A + Finish 6 Pro 21 oz/A fb Folex 6 EC 1.0 pt/A or Aim/Display/ET/Sharpen + ethephon 21 – 32 oz/A\*  
Thidiazuron 1.5 oz/A + Folex 4 – 6 oz/A fb Folex 6 EC 8 – 10 oz/A or Aim/Display/ET/Sharpen + ethephon 21 – 32 oz/A\*  
Folex 6 EC 0.5 pt/A + ethephon 21 oz/A or Finish 6 Pro 21 oz/A fb Aim/Display/ET/Sharpen + ethephon 21 – 32 oz/A\*  
Finish 6 Pro 1.5 – 2.0 pt/A fb Folex 6 EC 1.0 pt/A or Aim/Display/ET/Sharpen + ethephon 11 oz/A\*

## Category 7 – Warm temperatures; low regrowth potential; one-pass program; boll opening not required

Thidiazuron 1.5 oz/A + 0.25% NIS  
Thidiazuron 1.5 oz/A + Folex 6 EC 4 – 8 oz/A  
Folex 6 EC 12 – 16 oz/A  
Folex 6 EC 8 – 12 oz/A + ethephon 8 – 12 oz/A  
Ginstar 5 oz/A

**Category 8 – Warm temperatures; low regrowth potential; two-pass program; boll opening not required**

Thidiazuron 1.5 oz/A + Folex 6 EC 4 oz/A fb Aim/Display/ET/Sharpen\*

Folex 6 EC 12 oz/A fb Folex 6 EC 12 oz/A or Aim/Display/ET/Sharpen \*

Folex 6 EC 8 – 12 oz/A + ethephon 8 – 12 oz/A fb Folex 6 EC 12 – 16 oz/A (do not exceed 24 oz/A total Folex per year)

Ginstar 5 oz/A fb Folex 6 EC 12 oz/A or Aim/Display/ET/Sharpen\*

**Category 9 – Cooler temperatures; boll opening needed; one-pass program**

Folex 6 EC 12 – 16 oz/A + ethephon 32 – 40 oz/A or Finish 6 Pro 26 – 32 oz/A

Finish 6 Pro 32 oz/A + Aim/Display/ET/Sharpen\*

Ginstar 6 – 9 oz/A + ethephon 32 oz/A

Ginstar 6 – 9 oz/A + Finish 6 Pro 32 oz/A

**Category 10 – Cooler temperatures; boll opening needed; two-pass program**

Folex 6 EC 16 oz/A + ethephon or Finish 6 Pro 16 – 20 oz/A fb ethephon or Finish 6 Pro 16 – 20 oz/A (add PPO if needed)

Finish 6 Pro 32 oz/A fb Aim/Display/ET/Sharpen\* + Finish 6 Pro 11 oz/A

Aim/Display/ET/Sharpen\* fb ethephon or Finish 6 Pro 40 oz/A

Ginstar 7 – 9 oz/A fb ethephon or Finish 6 Pro 40 oz/A

**Category 11 – Cooler temperatures; one-pass program; boll opening not required**

Folex 6 EC 16 oz/A

Finish 6 Pro 32 oz/A

Aim/Display/ET/Sharpen\*

Ginstar 7 – 9 oz/A

**Category 12 – Cooler temperatures; two-pass program; boll opening not required**

Folex 6 EC 12 oz/A fb Folex 6 EC 12 oz/A or Aim/Display/ET/Sharpen\*

Aim/Display/ET/Sharpen fb Aim/Display/ET/Sharpen\*

Finish 6 Pro 32 oz/A fb Aim/Display/ET/Sharpen\*

Ginstar 7 – 9 oz/A fb Aim/Display/ET/Sharpen\*

\* Please refer to product label of your local University Extension Specialist for specific product rates and adjuvant requirements.

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Disclaimer

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture and University of Tennessee Extension assume no liability resulting from the use of these recommendations.

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