

# Louisiana Cotton Bulletin

Volume 6, Issue 13

August 25, 2009

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### **Crop Report, August 25, 2009**

**Donald J. Boquet, PhD**

The 2009 cotton growing season is rapidly winding down. Most fields around the state have open bolls ranging from 5% to 100%. Fields receiving defoliation treatments this week are, in general, those with the lowest yield potential because of poor growing conditions during some part of the spring and summer. Many of these fields had root damage because of the very wet conditions that occurred during early growth (Figure 1). Most of these root loss problems were not discovered until the weather turned dry in June and July. These fields with below one-bale yield potential represent a small part of the state's acreage. Defoliation of higher yielding fields will get underway in about one week when the early planted crop reaches 60% open bolls. This is the best time of year to look at fields to determine if there are problems to address or management changes to make in future years and to reflect on how management practices affected the crop. Are there any obvious disease, nematode or insect problems that could have been handled differently leading to a better outcome? Are there any obvious plant nutrient deficiencies that should be corrected? Or, in the case of nitrogen, was the application rate excessive, causing too much vegetative growth and delayed maturity? As a perennial, cotton does not exhibit senescence, like soybean or corn, when the crop is mature. Still, cotton should not, at the end of the growing season, have a dense dark green canopy. It should show some signs of running out of nitrogen – lower leaves turning red or yellow and upper leaves should be taking on a lighter green color -- indicating that just the right amount of nitrogen was applied for the current year's crop to make maximum yield. Excess nitrogen during the season and at maturity can lead to increased boll rot,



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increased defoliation costs and decreased harvest efficiency. These factors are usually more costly than any potential gain in yield from above optimal nitrogen fertility.

Selection of defoliates and timing of defoliation are critical decisions that can affect defoliation results and also lint yield and quality, and is still considered to be science and art. In fields where the top crop is much later than the bottom crop, which is the case with many fields this year, defoliation will have to be timed to maximize boll development of both crops. Bolls on the bottom and middle of the plant usually contribute more to yield than top bolls and this should be the primary consideration when timing defoliation. The defoliation article below written by Drs. Miller and Stephenson will be very helpful in making defoliation decisions.



Figure 1. Many Louisiana cotton fields had tap root damage as shown in this photo that occurred during early plant growth due to very wet soils. Lateral roots eventually developed to replace the tap root but could not fully support plant growth and yields in these fields have been greatly reduced.

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## Defoliation Guidelines for 2009

**Donnie Miller, PhD; Daniel Stephenson, PhD**

One of the last, but most important, steps in producing a cotton crop is harvest preparation. Successful harvest preparation includes scheduling for defoliation and harvest operations, removal of foliage and facilitating boll opening. Successful defoliation has many benefits including increased picker efficiency, elimination of trash in harvested seedcotton, faster drying of dew thereby increasing picking hours per day, straightening of lodged plants and reduction of boll rot incidence.

The activity of harvest aids is very dependent on environmental factors. Moreover, cotton defoliation is a balancing act between leaf injury that stimulates leaf drop, yet does not desiccate and stick leaves on the plant. No one harvest aid tank mix will work in all situations. A good understanding of the influence of defoliation timing and the relative attributes of available harvest aids can help in deciding when to terminate a crop and which harvest aids to use.

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## Defoliation Timing

There is always a balancing act between yield and fiber quality when defoliating cotton, but close attention to individual fields can help maintain quality while preserving yield. There are several accepted methods to time defoliation, and all methods have strengths and weaknesses. The following is a refresher of some of the more common defoliation-timing techniques.

**Percent Open Bolls** - The most widely used method is based on a determination of the total percentage of bolls in a field that have opened, with 60% of bolls open being the most common recommendation for defoliant application. In many situations, unopened bolls are mature enough to resist negative impact and will open before harvest. This method, however, has limitations. Research in Louisiana has shown that, depending on fruit distribution on the plant, maximum yield can be obtained when defoliation occurs before 60% open bolls. Additionally, in cases where a large fruiting “gap” (no bolls present at fruiting sites) occurs and a large percentage of bolls are less mature and set in the uppermost region of the plant, optimum defoliation timing may occur later than 70% open. Research evaluating optimum defoliation timing in Louisiana and other states has shown maximum yield can be achieved with application ranging from 42% to 81% open, depending on crop maturity and fruit distribution.

**Nodes Above Cracked Boll (NACB)** - The node above cracked boll (NACB) method, in contrast to the percent open boll method, focuses on the unopened portion of the crop. NACB is determined by locating the uppermost first-position boll that is cracked open with visible lint and counting the number of main-stem nodes to the uppermost harvestable boll. By focusing on the unopened portion, NACB takes into account potential fruiting gaps. Most recommendations call for defoliation at **four NACB**. Low plant population and skip-row cotton, however, are often more safely defoliated at three NACB. Lower plant population usually means a later-maturing crop, with a significant portion of yield coming from outer-position bolls and bolls set on vegetative branches.

**Accumulated Heat Units After Cutout** - Similar to NACB, a method developed in Arkansas recommends defoliation after accumulation of 850 heat units, or DD60s, after cutout. A DD60 is a measure of accumulated heat needed for growth and development using a 60° F minimum. Research from Louisiana indicates that under our conditions, the appropriate defoliation timing may be greater than 850 heat units (that is, 1050 heat units) beyond a cutout of node above white flower 4 (four main-stem nodes above uppermost first-position white flower). While this method does focus on the unopened portion of the crop and is supposed to allow enough time and DD60s for full development of all bolls, it requires making a determination of cutout. The definition of cutout is a moving target and can often be different for every field.

**Visual Inspection** - Whatever method is employed, growers should also visually inspect unopened bolls for maturity. A boll is considered mature if it is difficult to slice in cross-section with a knife and seeds have begun to form a brown or black seed coat. Once a dark seed coat has formed, defoliation will not affect yield of those bolls adversely. Cotton bolls need 40 to 60 days to mature, depending on temperature. Bolls set later in the season will take longer to mature and may never be harvestable. Growers should walk their fields before defoliation and examine only those bolls that can reasonably be expected to mature.

Research in Louisiana has shown that, on average, cotton is harvested from a 12-14 node range on the plant. This fact can serve as a tool to simplify identifying the last harvestable boll as well as timing

defoliation. To use the 12-node rule, identify the lowest first position boll that is expected to be harvested. Count up 12 nodes on the plant. The boll present at that position is likely to contribute to yield. Under some circumstance, a boll on the 14<sup>th</sup> node from the bottom could be considered harvestable. Bolls produced above that position on the plant are unlikely to contribute to yield and waiting on them to mature places heavier bolls at the bottom of the plant at risk to unnecessary weather-related losses. Once the last harvestable boll has been identified, use the visual inspection technique to determine when it is mature and ready for defoliation.

## Defoliation Materials

The following is a list of most of the products available for use as harvest aids and a discussion of their relative attributes. No one harvest aid, or tank mix combination, is appropriate for every field and all situations. The selection of a harvest aid is often made based on prior experience and price. When selecting a harvest aid or combination, consider environmental and crop conditions, yield potential and value of the crop in the field. All have strengths and weaknesses and perform better in some environments than others. Always read and follow label directions.

**Def 6, Folex 6 EC** - Def 6 and Folex 6 EC are phosphate-based compounds that provide good to excellent defoliation over a range of environmental conditions but minimal regrowth inhibition. Activity of these compounds improves with increased cutout of the crop. Def 6 or Folex 6 EC can be tankmixed with many other materials. Leaf removal is usually rapid, and addition of surfactants or crop oils has increased activity only under adverse conditions. Use rates can range from 4 oz. in combination with other defoliant to 1.5 pts of Def 6 or Folex 6 EC alone.

**Dropp, Freefall, Klean-Pik (thidiazuron)** - Thidiazuron is the active ingredient in several products sold under the trade names of Dropp, Freefall, Klean-Pik and Thidiazuron. Some are liquid and some are dry formulations.

Thidiazuron defoliates mature leaves as well as phosphate-based materials but also has excellent activity on juvenile leaves and inhibits regrowth. A minimum of 0.05 lb. ai per acre is needed for 10-14 days of regrowth inhibition. Higher rates will result in longer periods of regrowth inhibition. Thidiazuron alone is usually as good as or better than other defoliant in drought-stressed situations where leaves have thick cuticles. Thidiazuron is somewhat slower acting than other defoliant, and activity is temperature-dependent. Temperatures lower than 70°F will reduce activity. The addition of crop oil concentrate or a phosphate defoliant or insecticide will help the activity of thidiazuron under cooler conditions. Thidiazuron requires a 24-hour rain-free period; however, the addition of 2-4 ounces of Def 6 or Folex 6 EC may shorten the required rain-free period. It is important to follow suggested tank clean-out procedures to avoid premature defoliation when the sprayer is used the following year. A 0.5% silicone-based surfactant is recommended to aid in tank cleanout when thidiazuron is tankmixed with a phosphate defoliant or insecticide.

Thidiazuron is produced in dry and liquid formulations. Liquid formulations are Dropp SC, Freefall SC, and Thidiazuron 4 SC. Dry formulations are Freefall, Klean-Pik and Thidiazuron 50 WSB. At equivalent rates of active ingredient per acre, defoliation and regrowth control activity of liquid and dry formulations are similar. Limited research has indicated that the liquid formulations may be more prone to low levels of leaf desiccation when applied in combination with higher rates of Def 6 or Folex 6 EC and/or crop oil concentrate. The following table can be used to determine equivalent rates of thidiazuron in liquid and dry formulations:

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Active ingredient (lb/acre)	Dropp SC, Freefall SC and Thidiazuron 4 SC (oz. product/acre)	Freefall, Klean-Pik and Thidiazuron 50 WSB (lb product/acre)
0.05	1.6	0.10
0.075	2.4	0.15
0.10	3.2	0.20

**Ginstar EC** - Ginstar EC is a premix formulation of thidiazuron and diuron. Ginstar EC has all the positive attributes of thidiazuron alone and is more active under cooler conditions. Ginstar EC is also a strong inhibitor of terminal regrowth, but it is more likely to cause unwanted desiccation of cotton leaves than thidiazuron alone. Higher rates and tank mixtures increase this potential. Activity of Ginstar EC is similar to phosphate defoliants under cooler conditions and usually faster than thidiazuron alone in warm conditions. Ginstar EC is rate-sensitive. The label allows a range of 6.4 to 16 ounces per acre. Growers are cautioned that rates in excess of 10 ounces have shown a tendency to desiccate leaves. Ethephon-containing materials (Prep, SuperBoll, Finish, FirstPick) can be tank mixed at low rates for enhanced defoliation. The use of adjuvants with Ginstar EC is not recommended. Limited research in Louisiana has also shown some benefit to tankmixing 3 oz. of Ginstar EC with higher rates of Finish for defoliation and boll opening.

**Harvade** - Harvade provides effective defoliation of mature plants but is a weak inhibitor of regrowth. Harvade is less temperature-sensitive than phosphate defoliants and is reported to have better activity at lower temperatures. In combinations with ethephon, it can desiccate several weed species including morning glory and prickly sida but exhibits little activity on emerged juvenile growth. The addition of 0.5 to 1 pint per acre of crop oil is necessary for acceptable defoliation.

**Leafless** - Leafless is a combination of the active ingredient thidiazuron and dimethipin, the active ingredient in Harvade. Leafless provides the positive attributes of both active ingredients. Use rates range from 10 to 12 ounces. The addition of 0.5 to 1 pint per acre of crop oil is necessary for acceptable defoliation.

**Aim EC** - Aim has excellent activity in desiccation of juvenile growth but does not inhibit regrowth. In well-cutout cotton, and/or cool conditions, Aim activity has been shown to be similar to Def 6 or Folex 6 EC. In warm conditions, however, less than desirable defoliation and excessive desiccation have been shown with Aim at higher rates with crop oil concentrate. In situations in which two applications are necessary, Aim has performed very well as the second application. Aim has shown excellent activity in desiccating morning glories. Coverage is essential for optimum desiccation of weeds. In situations with thick vines, Aim alone or in combination with other defoliants will desiccate morning glories very well. Aim can be tankmixed with any of the other defoliants. The addition of an adjuvant is required and the Aim EC label recommends a non-ionic surfactant to be used in warmer conditions and crop oil concentrate to be used in cooler conditions. Limited research in Tennessee has suggested that the addition of 0.25% v/v of a non-ionic

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surfactant will decrease the likelihood of desiccation compared to Aim + crop oil. The recommended use rate is 0.5 to 1.6 oz/acre.

**ET** - ET is a PPO-inhibitor herbicidal-type defoliant. Activity with ET will be similar to Aim. The ET label allows tankmixing with all other defoliants, although tank mixes with Ginstar EC are not recommended due to the likelihood of desiccation. ET use rate is 1.5-2 oz. per acre.

**Resource** - Resource is a PPO-inhibitor herbicidal-type defoliant. Research with Resource as a cotton harvest aid is limited in Louisiana, but preliminary results suggests that it can be tank mixed with ethephon-containing products. Similar to Aim and ET, Resource should provide acceptable second-application defoliation of mature leaves and desiccation of juvenile regrowth. The Resource label suggest the addition of 1-2 pints of COC be added, or a non-ionic surfactant in hotter weather. Use rate is 4-8 oz. in one application and no more than 14 oz. total for the season.

**Blizzard** - Blizzard is a PPO-inhibitor herbicidal-type defoliant. Experience with Blizzard in Louisiana has been limited. Blizzard is a very active compound with low use rates. Labeled rates range from 0.5 to 0.6 oz. per acre. Blizzard can be tankmixed with ethephon-based products. Similar to other PPO-inhibitor defoliants, Blizzard should be very useful in desiccating juvenile foliage and as a second application prior to harvest. A crop coil concentrate or surfactant should be added to tank mixes containing Blizzard.

**Finish 6 Pro** - Finish 6 Pro contains ethephon and a synergist that aids in defoliation. Finish 6 Pro is an excellent boll opener and can be a stand-alone product in cooler weather and well-cutout situations. Finish 6 Pro also exhibits a limited level of regrowth control. Finish 6 Pro is generally a faster boll opener than ethephon and can be tankmixed with thidazuron, phosphate materials or Ginstar EC. Use rates of Finish 6 Pro should be 21-36 oz/acre applied alone or 21-36 oz/acre when tankmixed with other products.

**Glyphosate (many formulations)** - Glyphosate provides excellent regrowth inhibition of conventional (non-Roundup Ready) cotton when applied in conjunction with defoliants or ethephon and results in excellent johnsongrass control. Check specific product labels for registrations as a harvest aid.

**Sodium Chlorate** - Sodium chlorate is most effective in defoliating mature leaves and provides no regrowth inhibition or removal of juvenile growth. At higher rates, it acts as a desiccant, tending to stick cotton leaves. Sodium chlorate may be the best defoliant choice when temperatures are below 55 F. Application should not be made before cotton has 85% or higher open bolls. Sodium chlorate should not be tankmixed with ethephon-containing defoliants for safety reasons.

## **Boll-Opening Materials**

**Ethephon (Prep, Super Boll, Boll'd, Ethephon 6, others)** - With adequate spray coverage, Prep, Super Boll, Boll'd and Ethephon 6 accelerate the opening of mature bolls but are not labeled as defoliants. Therefore, they should be tankmixed with other defoliants. At low rates, ethephon can enhance the activity of other defoliants. Adequate time should be allowed before harvest for optimum boll-opening effect. FirstPick and Finish are combinations of ethephon and a synergist to increase defoliation and speed boll opening over ethephon alone.

**FirstPick (ethephon + synergist)** - FirstPick contains the boll opener ethephon and a synergist. It is an excellent boll opener. Acceptable defoliation with FirstPick alone requires cutout cotton with mature leaves. Therefore, tank mixes with other defoliants are generally recommended. In tank mix combinations, the use rate of FirstPick should be 1.5-2 qt/acre. FirstPick also has good defoliation activity, particularly on older leaves. Therefore, rates of tankmix partners may be reduced when used in combination with FirstPick.

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**Finish 6 Pro (ethephon + cyclanilide)** - Finish 6 Pro contains ethephon and a synergist that aids in defoliation and boll opening. Finish 6 Pro is an excellent boll opener that can be used in combination with other defoliant. Boll opening rates of Finish 6 Pro range from 21-37 oz/acre.

Deciding on whether or not to use a boll opener can be a difficult decision. Ethephon in any form generally enhances the defoliation activity of other products. Ethephon can also speed the days to being harvest-ready, particularly if applied at 60% or less open bolls. Ethephon will not, however, always open every boll. Bolls that are not mature at the time of application have little chance of opening in 12-14 days whether ethephon is used or not. Adequate spray coverage is essential. Therefore, ethephon can be applied with a defoliant or as a second application 3-4 days after a defoliant has been applied to increase spray coverage of targeted bolls. In general, boll openers are of the most value in good-yielding cotton and also as an aid in harvest scheduling. Ethephon-containing products should never be mixed with sodium chlorate for safety reasons.

**Paraquat (Gramoxone Inteon)** - Paraquat at lower rates (3-6 oz./acre) in addition to conventional defoliant may increase defoliation of juvenile growth and stimulate boll opening. It does not, however, inhibit regrowth. Growers are cautioned that higher rates may result in cotton leaf desiccation and “freezing” of closed bolls. It may be used as a spot treatment for weed desiccation and should not be applied at weed desiccation rates before cotton is at least 85% open and preferably after defoliation. There is a 3-day harvest interval following application of paraquat.

Publication 2927 (2009 Cotton Defoliation Guidelines for Louisiana) is an online reference that can be accessed on the LSU AgCenter webpage, [www.lsuagcenter.com/cotton](http://www.lsuagcenter.com/cotton), for additional information about cotton defoliation.

Table of Expected Activity of Various Defoliant

Material	Estimated minimum temperature	Expected Activity			
		Mature leaves	Juvenile growth	Regrowth prevention	Boll opening
Def 6/Folex 6 EC	60°F	Excellent	Fair	Poor	None
Thidiazuron	65°F	Excellent	Excellent	Excellent	None
Harvade	55°F	Excellent	Fair	Poor	None
Ginstar EC	60°F	Excellent	Excellent	Excellent	None
Aim	55°F	Excellent	Excellent	Poor	None
ET	55°F	Excellent	Excellent	Poor	None
Resource	55°F	Excellent	Excellent	Poor	None
Blizzard	55°F	Excellent	Excellent	Poor	None
Prep/SuperBoll, others	60°F	Fair	Poor	Poor	Excellent
Finish 6 Pro	60°F	Excellent	Poor	Fair	Excellent
FirstPick	60°F	Excellent	Poor	Poor-Fair	Excellent
Glyphosate	55°F	Fair	Fair	Excellent	None
Sodium Chlorate	55°F	Fair	Fair	Poor	None
Paraquat	55°F	Desiccation	Excellent	Poor	Fair

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Below is a list of contacts, parish and area field agents and state extension specialists. They are prepared to assist you with any questions or problems you have.

COTTON FIELD AGENTS			
PARISH	AGENT	PHONE	EMAIL
Avoyelles	Trent Clark Carlos A. Smith Jr	318-253-7526 318-253-7526	<a href="mailto:tclark@agcenter.lsu.edu">tclark@agcenter.lsu.edu</a> <a href="mailto:CSmith@agcenter.lsu.edu">CSmith@agcenter.lsu.edu</a>
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