Cotton Field Check

Preparing the Cotton Crop for Harvest: Strategies During a Compressed Season in 2011

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Defoliation:
Although it is one of the last management decisions in the cotton production cycle, defoliation timing and application are critical to producing a profitable crop. Improper timing will compromise both cotton yield and quality. In light of the premium and discounts for fiber quality the proper use of harvest aid chemicals is of paramount importance.

Influence of Crop Conditions on Harvest-Aid Chemicals

Nitrogen Nutrition Effects

- Influence vegetative growth and maturity and extent of natural senescence at time of defoliation
- High nitrogen concentrations in plant tissue delay abscission zone formation in both leaf petioles and along sutures in the boll walls. Fortunately this season most growers fertilized for a lower yield expectation due to the late start.

Relative Boll Load and Amount of Late-Season Vegetative Vigor

- High boll loads relative to the size of the plants tend to cause a more intense competition for nutrients and carbohydrates in the late-season, reducing late-season vegetative growth
- Low boll loads can lead to more vigorous late vegetative growth and more difficulties with defoliation and desiccation

Crop Water Status

- Water stress severe enough to produce leaf wilting can delay harvest aid chemical absorption at the time of defoliation and tends to reduce response to harvest aids
- Increasing water stress hastens boll opening, but sufficient moisture must remain for defoliants to activate the abscission layer. Most fields were irrigated later this season to fill out the later maturing bolls.

Importance of Proper Timing

- There are economic incentives to defoliate and get started earlier with harvest operations including better weather and more hours for harvest with earlier starting dates
- However, fiber development must be advanced enough prior to initiating harvest aid applications. Initiation of harvest aid applications too early can reduce fiber quality and yield
- Decisions have to be made field-by-field

Best Conditions for Effective Defoliation

- Moderate to high air temperatures (days >80F; nights >60F)
- Relatively low plant and soil nitrogen levels
- Soil water levels moderate (plants should not be very water stressed)
- Uniform crop development and uniform boll distribution in canopy
- Crop at vegetative cutout
- Weeds, insects and diseases under control
- Complete defoliant coverage when applied, good chemical penetration within the plant canopy

The effectiveness of harvest aids in preparing crops for harvest varies each season and often from field to field, and relative effectiveness can

depend on the factors mentioned on the previous page as well as soil texture and depth (influences rooting depth, nutrient and water holding capacity) and prevailing day and night temperatures). Temperatures can impact the rate of maturation of developing bolls, but also can impact absorption and activity of harvest aid chemicals and how they impact plant tissue and metabolic processes.

Research suggests some minimum temperatures for optimum performance of specific harvest aid chemicals:

Minimum temperatures for optimum harvest aid performance (degrees F)	
Sodium chlorate (e.g. Defol, others)	50
Paraquat (e.g. Gramoxone, Shark, ET)	<50
Tribufos (e.g. Folex, Def)	55 to 60
Dimethipin (e.g. Harvade, others)	55
Ethephon and ethephon-containing products (e.g. Prep, Finish, Cotton Quik)	60
Thidiazuron (e.g. Dropp, others) and thidiazuron + diuron (e.g. Ginstar, Adios)	65
Night temperatures above 60F are best for defoliation; below 60F slows defoliation	

Factors to consider when selecting a defoliation strategy

Guidelines were developed to manage two basic scenarios:

(1) Fields with uniform and/or heavy boll load with abrupt vegetative cutout, versus

(2) Late plantings and/or fields where plants have lower boll retention or uneven boll distribution, with tendencies toward rank growth

Some of the generalizations that can be made for management recommendations apply to both Pima and Upland/Acala types of cotton, but where significant differences in recommendations are known to exist, some additional comments will be made.

Scenario (1) Fields with heavy boll load, abrupt cutout, and warm temp >80º F. at application.

- When plants have a relatively high boll load and good boll distribution in the plant canopy, they also tend to limit late-season vegetative growth and come to a more complete cutout
- When irrigation termination and nitrogen depletion are synchronized with boll maturity, these moderate to high-yielding fields become easier to defoliate.
- Ginstar treatments usually give effective defoliation. Lower rates (4-6 oz) of Ginstar or Adios should be effective. Def and Folex in combination with ethephon are effective.
- When using a Ginstar/Adios-based program, it is better to start with the lowest rate of product appropriate for the prevailing air temperature and plan on a second application as needed to promote effective defoliation. First application rates that are too high tend to "freeze" the leaves on the plant rather than promote eventual leaf drop/abscission.
- Standard rates of chlorate plus paraquat, ET, or Shark as secondary treatments are effective.

Scenario (2) Late plantings, low bottom retention, rank growth in Acala or Pima, or cool temperature <80 F. at application, vigorous growth, late-maturing fields with smaller boll loads.

- With these more vigorous plants with a high proportion of later-maturing bolls, it may be desirable to consider some different practices to improve chances for acceptable defoliation and desiccation, to control regrowth, and to improv chances of getting later-maturing bolls to open.
- Growers will need to look at the calendar, judge the likelihood that good weather will continue, and decide which bolls they really can afford to wait for.
- Sequential harvest aid applications are typically needed under these conditions for both Pima and Acala types of cotton. The first application aims to have impacts on the upper canopy and "open up" the leaf canopy. Higher rates are required on second application to defoliate or desiccate remaining leaves.

- "Pre-treatment" chemical applications may need to be considered under this set of plant and environmental conditions ("pre-treatments" refers to first harvest aid applications made when open boll percentages are lower than we typically look for (perhaps < 20 to 30%) and NACB (nodes above cracked boll) are still higher than we typically look for in scheduling first harvest aid applications (perhaps NACB > 8 or more).
    - Ginstar/Adios or ethephon-containing materials can be helpful when needed as pre-treatment harvest aids
    - Sequential applications are a must with pre-treatment approaches, as the pre-treatment application is aimed at helping open some bolls or initiating upper leaf canopy desiccation and leaf loss.

Strategies to Consider

Strategy One: UCCE studies demonstrated benefits in defoliation and boll opening by applying a pre-treatment of 4-6 oz of Ginstar at about 40 percent open boll or 6 nodes above cracked boll (NACB) followed by later treatments (at 4 NACB) of: (1) Ginstar at 6-8 oz; or (2) Ginstar in combination with a boll opener material (such as Prep, Cotton Quick, Finish or others); or (3) Def/Folex plus a boll opener. Ginstar rates should be adjusted if changes in air temperatures occur at application or are anticipated in the days following application. In many cases in both Acala and Pima, a final application of sodium chlorate and Paraquat or Shark or ET will also be useful in desiccating remaining leaves and improving opening of last-remaining bolls. Applying ethephon at 6 NACB or sooner slightly reduced yield and quality compared to 4 NACB in some years but may be necessary to hasten harvest. In 2010 Pima yields increased by almost ½ bale but reduced micronaire by 20%.

Strategy Two: Another approach for vigorous, late-maturing cotton fields, particularly when there are concerns that the fields are just not making progress in opening up bolls, involves use of glyphosate as a pre-treatment in non RR varieties. Results showed some advantages in earlier opening of later-developing bolls with the glyphosate pre-treatments. Glyphosate should not be applied before about 8 NACB for these pre-treatments in Acala varieties, since the research showed yield losses of 5 to 12% with earlier applications at 10 NACB. Ginstar/Adios has been effective on late-maturing Pima if it does not appear to be changing in maturity (NACB is not declining much over a period of weeks). If and when cotton moves closer to the 6 NACB level, then start with the pretreatments of Ginstar or Ginstar plus ethephon.

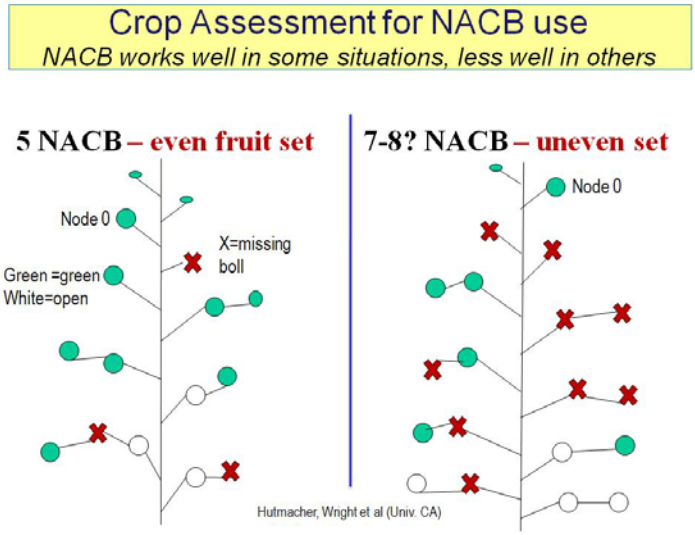
Harvest Aid Chemical Choices - considerations

	Advantages	**Disadvantages**
Ginstar, Adios	Very effective, no odor, regrowth control	Crop rotation Restrictions
Def/Folex+ ethephon	Very effective, cool weather performance better than some chemicals, whitefly control	Odor, spray restrictions
Sodium chlorate + paraquat Shark, ET	Less effective cheap, warm-cool weather performance Replacement for above and cheap, broadleaf control	Salts with Sodium Chlorate

Use of NACB (Nodes Above Cracked Boll) Approach for Defoliation Timing Assessments.
Under conditions of relatively uniform boll distribution in cotton plant canopies, the following are recommendations for NACB for first harvest aid application timing:

- 3 nodes above cracked boll for Pima cotton
- 4 nodes above cracked boll for Acala / Upland cotton

Many California growers are familiar with data sets from University of California Acala and Upland cotton defoliation trials in the 1980's and 1990's which suggest that, on the average, defoliations initiated at 8 NACB would result in yield losses of about 5% when compared with initiation at 4 NACB, while those initiated at 6 NACB would reduce yields 2 to 3%.



However, those same studies acknowledged that when a very large percentage of the total crop consists of bolls on the upper 6 to 9 fruiting branches, losses from early defoliant applications can be substantially more (over 10%). Particularly under circumstances of mostly a mid-canopy and top-crop, the closer you can get to 4 to 6 NACB prior to first defoliant application, the lower the yield loss.

<u>Alternatives to Nodes Above Cracked Boll Assessments for Defoliation Timing Assessments</u>
Pay attention to the calendar, the weather, and consider how much risk you want to take in choosing a final harvest date. Consider these steps:

1. Keep an eye on predicted trends in the weather.
2. Consider your own experience with how many days of harvest will likely be needed from harvest of your first field to the last field.
3. Decide what you think is the last harvest date you consider to be an acceptable risk.
4. Count back about 21-28 days from those desired harvest dates, and start with your defoliation program on those dates no matter what maturity stage (what NACB) the crop is in.

Specific Harvest Aid Options to Consider for Vigorous, Late-Maturing Fields in the San Joaquin Valley

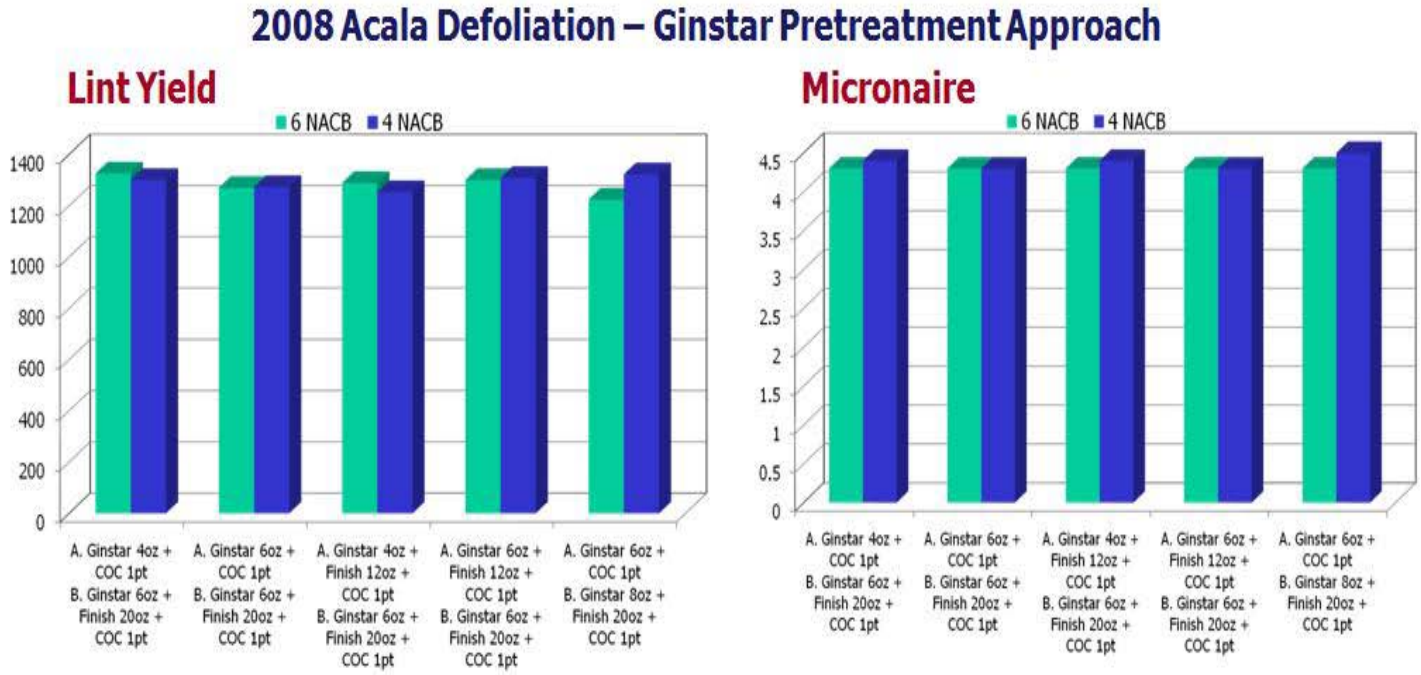
A. <u>(First Application):</u> at 6-7 NACB (approximately 30 to 40% open boll (OB))
Pre-treatment of 3-6 oz of Ginstar treatments or 3-6 oz of Ginstar, Adios treatments plus a boll opener (more aggressive). Start first application at 8 NACB for late-maturing Pima. You may need to go even earlier on Pima if the crop is not maturing due to cold weather.

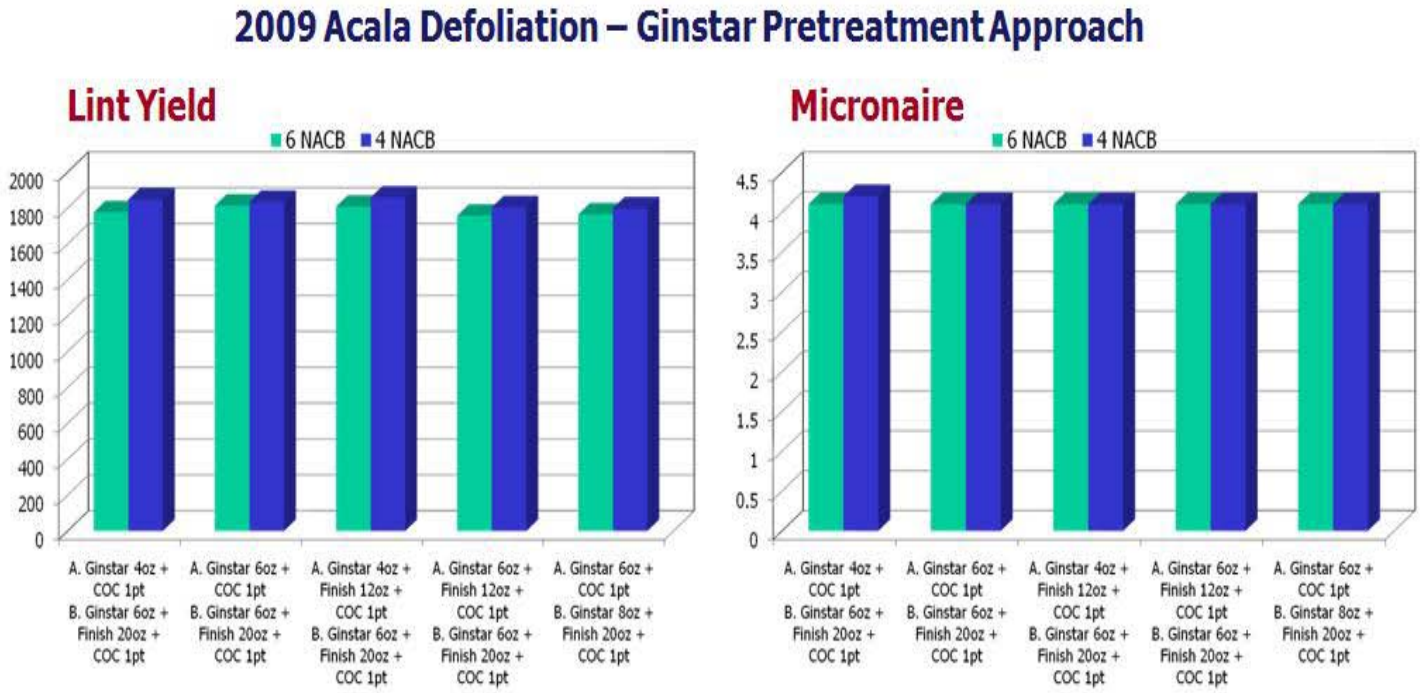
B. <u>(Second Application):</u> at 3-4 NACB (50-65% OB)
Ginstar, Adios at 5-10 oz; in combination with a boll opener material (such as Prep, Cotton Quick, Finish); or Def/Folex or ET, Shark, plus a boll opener material or Sodium Chlorate plus paraquat.

C. In many cases in both Acala & Pima, a final application of sodium chlorate plus Paraquat, Shark, or ET will also be useful in desiccating remaining leaves & improving opening of last-remaining bolls. Shark or ET applications will also help dry remaining broadleaf weeds.

More recent University of CA studies also provide some additional examples of relative impacts of timing of harvest aid applications on lint yield and on specific quality parameters such as micronaire, and examples are shown below.

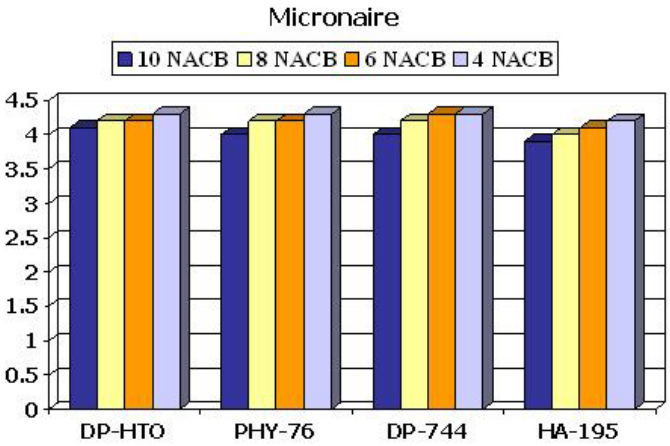
The pre-treatment approach impacts on yield and micronaire from 2008 and 2009 studies on Acala involving first harvest aid applications at 6 versus 4 NACB timings are shown in the figures below. Chemical materials applied and rates are shown on the "X" axis, with the (A) grouping showing the materials applied at the first application, and the (B) group indicating the second/sequential application timing.





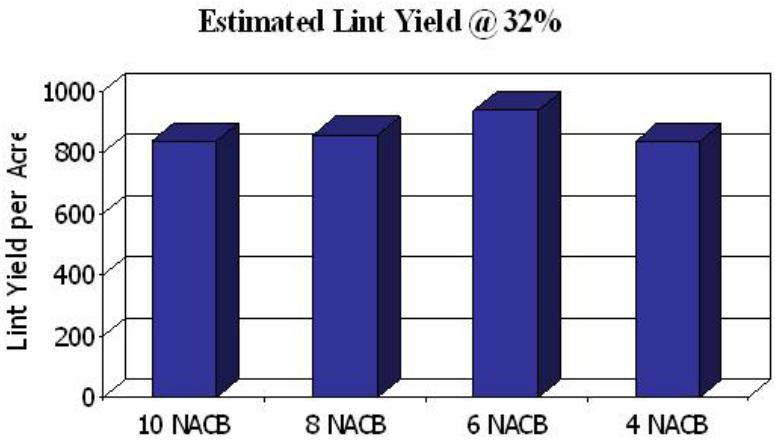
The pre-treatment approach impacts on yield and micronaire from 2003 and 2005 studies on Pima involving first harvest aid applications at various NACB timings are shown in the figures below. Chemical materials applied and rates are shown on the "X" axis under the 2005 figure, with the (A) grouping showing the materials applied at the first application, and the (B) group indicating the second/sequential application timing.

2003 Pima Variety by Timing Defoliation Study



Yields for varieties below are from 2003 studies

2005 Pima Variety Defoliation Timing PHY-800



A. Ginstar (13oz) + CottonQuik (1.75qts)

B. Defol6 (3qts) + Gramoxone Inteon (10.7oz) +