2017 High Plains Cotton Harvest-Aid Guide

Dr. Seth Byrd, Assistant Professor – Extension Cotton Specialist, Lubbock
Dr. Wayne Keeling, Professor – Agronomy & Weed Science, Lubbock
Dr. Gaylon Morgan, Professor – State Extension Cotton Specialist, College Station

Harvest-aids in cotton are utilized to remove foliage, prevent regrowth, and open bolls to allow for timely harvest operations so that yield and quality losses due to weathering can be minimized. Defoliation and boll opening are natural processes governed by plant hormones and harvest-aids are used to speed up these naturally occurring processes. The timing of harvest-aid applications is primarily governed by crop maturity, but environmental conditions also play a role in timing of application, the products used, and rates applied.

Recommendations regarding the timing of applications are based on crop maturity status and there are various methods or crop growth maturity characteristics utilized. The most common recommendations are timing applications at: 1. four nodes from the uppermost first position cracked boll to the uppermost first position harvestable boll (4 NACB) or; 2. 60-70% of the harvestable bolls on the plant are open (60-70% open bolls). However, these two methods are often not correlated to the same time, in other words 4 NACB doesn't necessarily equate to 60-70% open bolls so a combination of the two may be used, and timing of harvest-aid applications should be made on a field by field basis. Boll distribution, variety maturity, and management practices can impact both of these measurements and in-field variability between NACB and % open bolls can be high, so taking into account the status of the majority of the plants in the field is recommended. **Both of these measurements should be based on the amount of harvestable bolls on the plants, so only mature bolls should be taken into account.** While harvest-aids can hasten the natural process of defoliation and boll opening, they do not influence boll maturity. Boll maturity can be determined by slicing the boll horizontally to expose the developing lint and seeds. A mature boll should be firm and difficult to slice, with mature seeds (fully developed cotyledons with little liquid or "jelly" in the seeds) with a dark seed coat, and the lint stringing-out when the two halves are separated.

A wide array of harvest-aid products is available for use in cotton. These products typically fall into one of four general categories, boll openers, defoliants, regrowth inhibitors, and desiccants, although some products may serve multiple purposes. For example, boll openers (active ingredient – ethephon) will provide some defoliation, especially in warm sunny conditions. The selection of products should be based both on the crop condition and what is

needed (leaf removal, regrowth inhibition, and/or boll opening) to prepare the crop for harvest, the environmental conditions at application and in the short-term (3 – 5 days) following application, and the yield potential of the field which should influence the amount of additional financial investment that is justifiable. The tables below provide harvest aid recommendations and general information on the function of the different active ingredients, use rates, and some common names of products. As always, follow the label regarding use rates and adjuvants/surfactants. Many product labels will also include information on rates based on environmental conditions (mainly temperature and humidity).

Regardless of product selection or crop condition, there are a few key considerations that need to be kept in mind regarding harvest aid performance and crop response:

Harvest-aid applications:

- Spray coverage is key; droplet size and carrier volume critically important. Nozzles used for post-emergence applications of new auxin herbicides are not suitable for harvest-aids. Smaller droplets and/or increased carrier volume will result in better coverage.
- Ground speed – slower typically allows for better coverage down in the crop canopy.

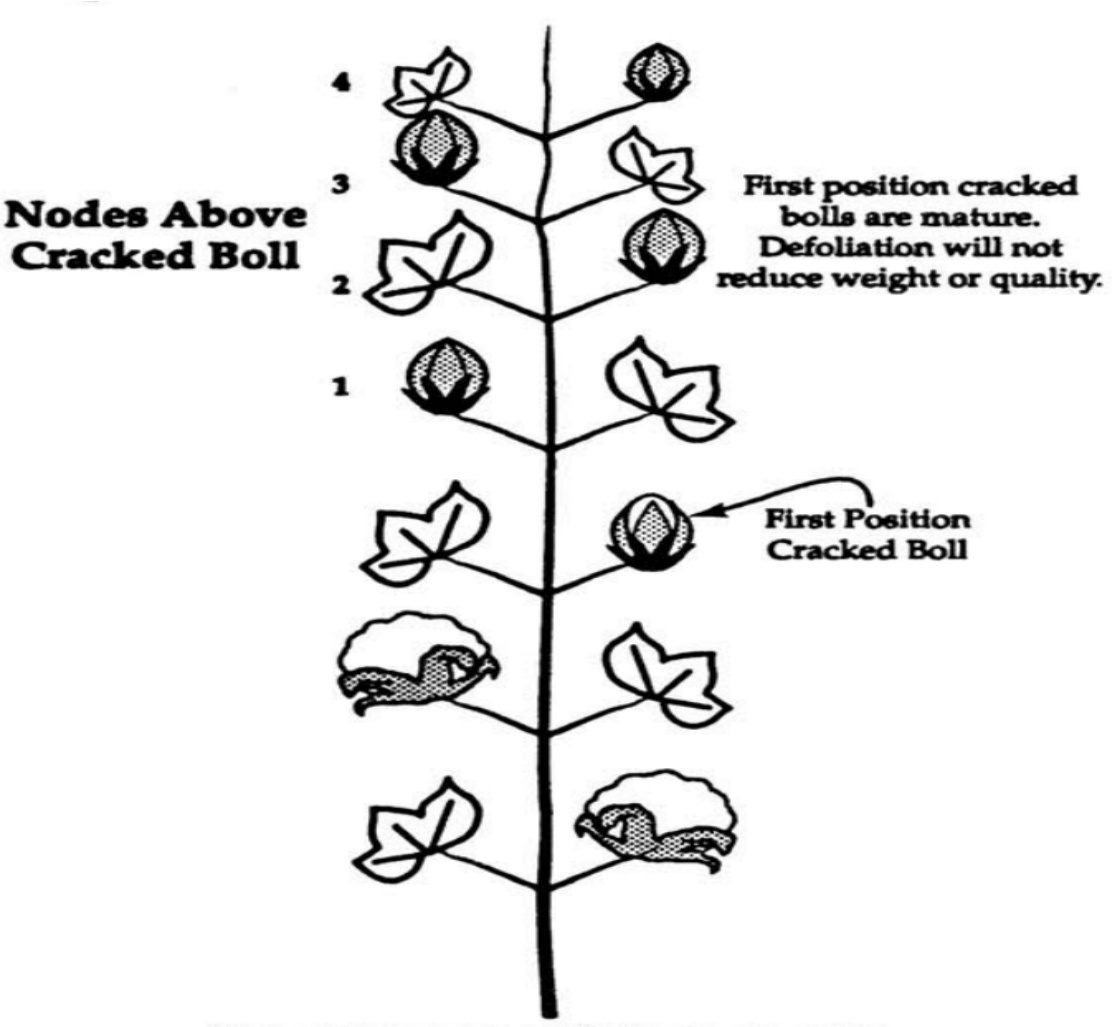
Crop Condition:

- Terminal regrowth – typically caused by excess moisture and/or excess N in conjunction with temperatures that favor growth.
    - Can be significant if conditions are present that are favorable for vegetative growth and can lead to high module moisture and lint staining.
    - Typically controlled by normal defoliation (tribufos or PPO) products, but leaf removal will be key, don't want to desiccate and stick leaves to the top of the plant.
    - PGRs won't do much to effect regrowth – internodes are already short and leaf area is only reduced 5 – 10% while leaf thickness is increased. Regardless, by the time we see regrowth PGRs won't have an impact on internode length.
- Basal (juvenile) regrowth – can occur after plant has been defoliated if conditions that favor growth are present. Sunlight is able to penetrate canopy and initiate growth on the lower axillary nodes of plants.
    - Tribufos or PPO defoliant, or thidiazuron + diuron products are typically effective in removing juvenile regrowth. Mix with thidiazuron + diuron product to inhibit some future potential for further juvenile regrowth.
    - This is often seen in fields where verticillium wilt has resulted in premature defoliation. If verticillium wilt is present and caused significant defoliation watch for the initiation of regrowth from the bottom of the plant.

Timeline for Harvest-Aid Effect:

Minimal timing for full effect; this will increase with adverse conditions (cool weather, drought toughened plants, etc.).

- Defoliants (tribufos or PPOs) – 7 days
- Defoliants/regrowth control – (thidiazuron or thidiazuron + diuron) – 14 days
- Boll openers – (ethephon) 7 – 14 days.
- Desiccants – (paraquat) 5 – 7 days; **do not apply to picker-harvested cotton**



Determining unopened boll maturity using Nodes Above Cracked Boll (NACB) technique.

Source: Guthrie, D., Cothren, T., and Snipes, C. 1993. The art and science of defoliation. Cotton Physiology Today Volume 4, No. 7, National Cotton Council, Cordova, TN.

Active ingredients, common trade names, and application considerations.

Defoliants		
Trade Names (Manufacturer)	Active Ingredients	Considerations
	Organophosphate	
Folex 6 EC (Amvac)	Tribufos	Reduced activity under low temps, low humidity, or stressed plants with higher rates under these conditions.
	PPO Inhibitor	
ETX (Nichino)	Pyraflufen-ethyl	Addition of COC recommended
Aim EC (FMC)	Carfentrazone-ethyl	NIS required at higher temps, COC required at lower temps. 7 day PHI.
Display (FMC)	Carfentrazone-ethyl + Fluthiacet-methyl	
Resource (Valent)	Flumiclorac pentyl ester	Addition of COC or MSO; NIS if warm, sunny conditions.
Sharpen (BASF)	Saflufenacil	Addition of MSO + AMS **or** UAN required.
Defoliants/Regrowth Inhibitor		
Freefall (Nufarm)	Thidiazuron	Higher use rates and addition of COC with temps < 65 F, or in drought conditions. Thidiazuron alone not typically recommended due to low overnight temps in the High Plains.
Daze (Winfield)		
Klean-Pik (Mana)		
Take Down (Loveland)		
Thidiazuron (Arysta)		
Ginstar EC (Bayer)	Thidiazuron + diuron	Minimum 12 hours rain-free after application for optimal performance. Higher rates required if low humidity is present.
Cutout (Nufarm)		
Adios (Arysta)		
Redi-Pik (Mana)		
Boll Opening		
Super Boll (Nufarm)	Ethephon (6 lbs. ethephon/gal)	7 day PHI. Minimum 6 hour rain-free period for optimal performance. Higher rates under cool and/or dry conditions, or on toughened/drought stressed foliage.
Boll'd (Winfield)		
Boll Buster (Loveland)		
Ethephon 6 (Arysta)		
Several other trade names		
Flash (Helena)	Ethephon (3 lbs.)	
Finish 6 Pro (Bayer)	Ethephon (6 lbs.) + cyclanilide	
First Pick (Nufarm)	Ethephon (2.28 lbs.) + urea sulfate	
Desiccants		
Gramoxone Inteon (Syngenta)	Paraquat (2 lbs. paraquat/gal)	Addition of NIS recommended.
Gramoxone SL2.0 (Syngenta)		
Firestorm (Chemtura)	Paraquat (3 lbs.)	
Parazone 3 SL (Amvac)		
Several other trade names		

COC – crop oil concentrate; NIS – nonionic surfactant; MSO – methylated seed oil; AMS – ammonium sulfate; UAN – urea ammonium nitrate; PHI – pre-harvest interval.

Harvest-Aid Decision Table (all units in per acre basis). This lists several available options but is not mean to be exclusive.

Crop Condition	Harvest-Aid Options[1]
Short stature (12 – 14 inches); low/limited yield potential (< 500 lbs./acre).	PPO inhibitor defoliant (rates vary) with or without the addition of a boll opener.
	PPO inhibitor defoliant (rates vary) FB[2] PPO inhibitor defoliant (rates vary).[3]
	Paraquat formulation at 8 – 16 oz (2 lb.) **or** Paraquat at 5.3 – 10.7 oz (3 lb.).
	Paraquat at 4 – 12 oz (2 lb.) FB paraquat up to 48 oz (2 lb.) **or** paraquat at 2.6 – 5.3 oz (3 lb.) FB paraquat up to 32 oz (3 lb.).[4]
	Paraquat at 6 – 24 oz (2 lb.) **or** Paraquat at 4 – 6.7 oz (3 lb.) + tribufos at 8 – 16 oz **or** PPO inhibitor defoliant (rates vary).[5]
Medium stature (15 – 24 inches); 500+ lbs./acre yield potential.	Ethephon (6 lb.) at 16 – 42 oz **or** (ethephon + cyclanilide) at 16 – 42 oz + tribufos at 8 – 16 oz.
	Ethephon (6 lb.) at 16 – 42 oz **or** (Ethephon + cyclanilide) at 16 – 42 oz + (thidiazuron + diuron) at 3 – 8 oz.
	Ethephon (6 lb.) at 16 – 42 oz **or** (ethephon + cyclanilide) at 16 – 42 oz + PPO inhibitor defoliant (rates vary).[3]
	PPO inhibitor defoliant (rates vary)[3] + tribufos at 8 – 16 oz **or** PPO inhibitor defoliant at 0.6 – 8 oz[3] + (thidiazuron + diuron) at 3 – 8 oz.
	PPO inhibitor defoliant (rates vary)[3] FB[2] PPO inhibitor defoliant (rates vary).[3]
	Paraquat at 6 -24 oz (2 lb.) **or** paraquat at 4 – 16 oz (3 lb.) + tribufos at 8 – 16 oz.
	Paraquat at 6 – 24 oz (2 lb.) **or** paraquat at 4 – 16 oz (3 lb.) + PPO inhibitor defoliant (rates vary).[3]
	Paraquat at 4 – 8 (2 lb.) oz FB paraquat up to 48 oz total (2 lb.)[3] **or** paraquat at 2.6 – 5.3 oz (3 lb.) FB Paraquat up to 32 oz total (3 lb.).[4]
	(Ethephon + urea sulfate) at 48 – 64 oz + (thidiazuron + diuron) at 3 – 8 oz.

Harvest-Aid Decision Table continued (all units in per acre basis). This lists several available options but is not mean to be exclusive.

Crop Condition	**Harvest-Aid Options[1]**
Tall stature (> 24 inches); 1000+ lbs./acre yield potential.	Ethephon (6 lb.) at 21 – 42 oz **or** (ethephon + cyclanilide) at 21 – 42 oz + tribufos at 8 – 16 oz.
	Ethephon (6 lb.) at 21 – 42 oz **or** (ethephon + cyclanilide) at 21 – 42 oz + (thidiazuron + diuron) 3 – 8 oz.
	(Ethephon + urea sulfate) at 48 – 112 oz + (thidiazuron + diuron) at 3 – 8 oz.
	Ethephon (6 lb.) at 21 – 42 oz **or** (ethephon + cyclanilide) at 21 – 42 oz + PPO inhibitor defoliant (rates vary).[3]
	(Ethephon + urea sulfate) at 48 – 112 oz + PPO inhibitor defoliant (rates vary).[3]
Other Conditions	**Harvest-Aid Options[1]**
Desiccating application for stripper harvest preparation (not to be used for picker-harvested cotton).	Paraquat at 16 – 32 oz (2 lb.) **or** paraquat at 11 – 21 oz (3 lb.)
Conditioning treatment for late maturing cotton. Apply after daily heat units drop below 5, target 7 days before first killing freeze date.	Paraquat at 4 – 16 oz (2 lb.) **or** paraquat at 2.6 to 10.7 oz (3 lb.).
	Ethephon (6 lb.) at 21 – 42 oz.

[1]Actual rates needed will depend on weather conditions (high and low temperatures, humidity). Higher label rates are typically recommended under cooler and dryer conditions. Check the label for specific details on rates.

[2]FB = followed by.

[3]Rates will depend on product selected; check the label for appropriate rates for the selected product. No more than: 3.2 oz/acre total of Aim EC, 2.0 oz/acre total of Display, 2.0 oz/acre total of Sharpen, 3.4 oz/acre total (no more than 2 applications) of ETX, and 14 oz/acre (no more than 2 applications, max of 8 oz per single application) of Resource may be applied during the growing season.

[4]No more than 0.75 lb./acre of paraquat active ingredient may be applied (in up to 3 multiple applications in one season based on the Texas Special Local Need 24c label. The second application should depend on the green leaves remaining and the rate applied in the first application; use higher rates if excessive regrowth is present.

[5]Labeled tank mix partners for paraquat include Folex, ETX, and Sharpen.