2012 High Plains and Northern Rolling Plains Cotton Harvest-Aid Guide

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INTRODUCTION

Harvest-aid chemicals are generally applied to hasten harvest of a mature crop, and to reduce potential preharvest losses of lint yield and fiber quality. Proper use of harvest aids can result in earlier harvest, preservation of fiber quality, and fewer seed quality reductions due to field exposure. Weathering losses in the High Plains can result in considerable reduction in dollar value of the crop, unless measures are undertaken to protect yield and quality potential. This is especially true for open boll picker-type varieties and lesser storm-proof stripper types. Timing of harvest-aid chemical applications is critical and different methods and considerations for determining the correct time may be utilized. Premature harvest-aid applications can result in loss of lint and seed yield and reduced fiber quality which ultimately can result in reduced profits or greater economic losses. Although studies indicate that maximum yield and quality occur at different stages, correct timing of harvest-aid applications can enable producers to obtain optimum yields of high quality lint and seed. However, even when applications are made under ideal conditions, inclement weather or lack of available machinery and/or labor can delay harvest for several days or longer. Delayed harvest timings can have adverse effects on both yield and quality of lint and seed. Cotton producers in the Texas High Plains face difficult decisions at harvest time that have profound impact on yield and quality. A comprehensive 3-year project (2000-2002) to address the fundamental data requirements of stripper harvested cotton was conducted in the Texas High Plains near Lubbock. The field was planted to a storm-proof variety, Paymaster 2326RR, and the treatment structure included harvest-aid chemical termination with varied harvest dates. Lint yields were reduced with later harvest dates one out of three years. Also, results from HVI analyses indicated significant reductions in fiber quality when harvest was delayed, most notably were length, strength and color grades. These fiber quality reductions subsequently resulted in lower lint loan values and ultimately, lower net values per acre. When considering planting seed quality, later harvest dates tended to reduce germination percentages two out of three years. This is an important consideration for individuals producing planting seed for companies or for those that retain seed for planting next year's crop. Even though a storm-proof variety was utilized during this study, the results indicate that significant reductions in lint yield, HVI fiber quality, economic returns, and seed quality can occur if harvest is delayed. Greater losses may be incurred with delayed harvest if a variety with a lesser degree of storm resistance is produced. Research results stress the importance of timely harvest aid applications and subsequent harvest for optimizing yield and fiber quality for greater net returns.

Proper harvest-aid product selection, tank mix partners and rates vary with environmental and crop conditions. What works best in one year is not necessarily the best for the next season. Efficacy of harvest-aid chemicals is always a concern. There are several factors that affect the performance or lack of performance of harvest-aid chemicals.

Some factors that increase the performance of harvest-aid chemicals include the following:

- Warm, calm, sunny weather
- Soil moisture relatively low but sufficient to maintain cotton plant in active growth condition without moisture stress
- Soil nitrogen levels relatively low
- Leaves active and uniformly expanded on plants
- Little or no secondary growth evident on plants
- Plants with a high percentage of open bolls that have shed some mature leaves

Conversely, some of the factors which negatively affect harvest-aid chemical performance include:

- Applications made under cool (below 60^{o} F), cloudy conditions
- Prolonged periods of wet weather following treatment
- Plants in vegetative growth state with low fruit set
- Plants severely moisture stressed with tough, leathery leaves at time of treatment
- High soil moisture and nitrogen levels which contribute to rank, dense foliage and delayed maturity
- Plants exhibiting secondary growth (regrowth) following a "cutout" period
- Improper calibration of application rates and poor spray coverage

CROP MATURITY DETERMINATION

Crop maturity determination is critical for a successful harvest-aid program. Premature crop termination has been shown to reduce lint yield, seed quality, micronaire, and fiber strength. Desiccants generally abruptly terminate fiber and plant development. **Harvest-aid chemicals cannot increase the rate of fiber development.** Only additional good growing weather including open skies and adequate heat units combined with functional leaves can mature cotton bolls. Maturity can be determined by using a sharp knife to cut into the bolls. If the boll is watery or jelly-like on the inside, then it is immature and needs more heat units. If boll development is such that the knife cannot slice through the lint, then the boll is nearly mature. Close inspection of the seed will give further indication of boll maturity. If the seed coat is turning tan and the seed leaves (or cotyledons) are fully developed, the boll is mature.

When determining boll maturity of adjacent fruit, one can consider the following. When moving up the plant from a first position boll that has just cracked to a first position unopened boll on the next fruiting branch, about 60 additional heat units (DD60s) are required to obtain similar boll maturity. If moving out from a first position boll to a second position boll on the same fruiting branch, about 120 heat units will be required to reach the same level of maturity. For an individual boll, a total of about 800-850 heat units are required after pollination to produce normal size and quality. However, bolls obtaining fewer heat units may still make productive lint of lower micronaire that may contribute to final yield.

Nodes above cracked boll (NACB) is a tool that can be used to time harvest aid application (Figure 1). A Beltwide cotton harvest aid project was conducted over multiple sites and years by Kerby, Supak, Banks, and Snipes. It was determined that if the uppermost first position-cracked boll is within three nodes of the uppermost harvestable first position boll then no lint weight will be lost if a defoliant-type harvest aid is applied at that time (Figures 1 and 2). However, if the uppermost harvestable first position boll is four or more nodes above the uppermost first position cracked boll, then potential for some lint loss exists. The lint loss potential increases as the NACB increases. Micronaire reduction generally follows a similar pattern when using the nodes above cracked boll criterion. When defoliant type chemicals are applied, some slight subsequent fiber development may occur before defoliation. If applying desiccants, more bolls must be mature in order to reduce the risk of fiber weight loss or reduction of micronaire, thus two to three NACB would be a better target.

Figure 1. Determining nodes above cracked boll.

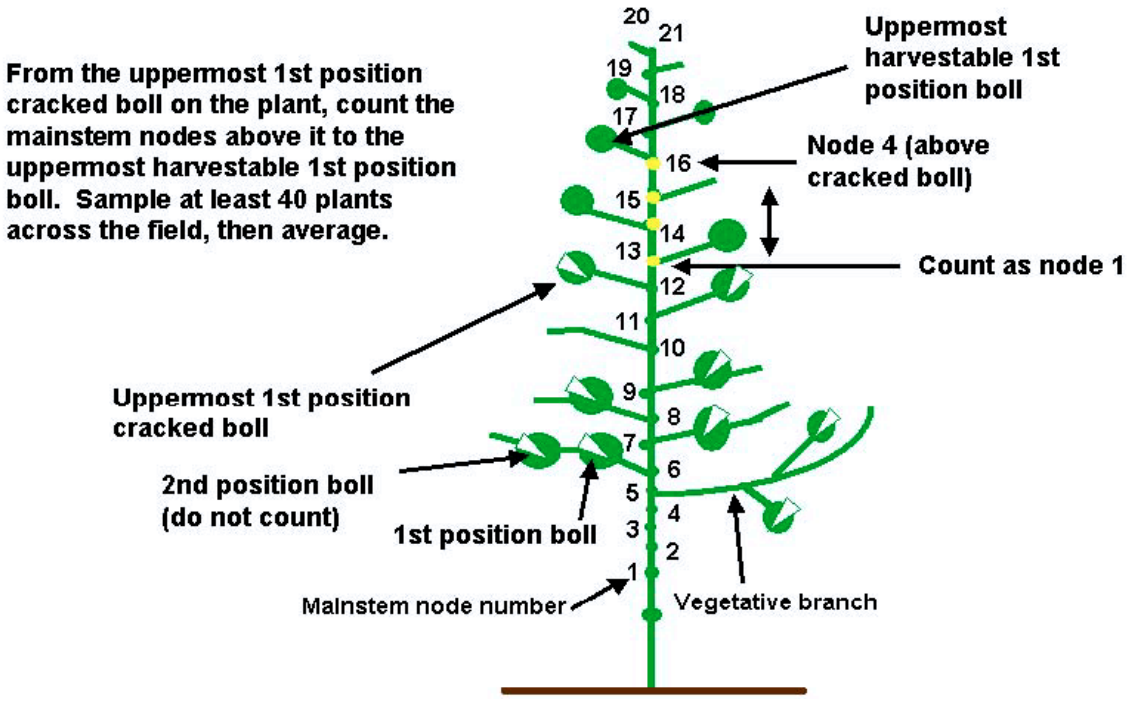
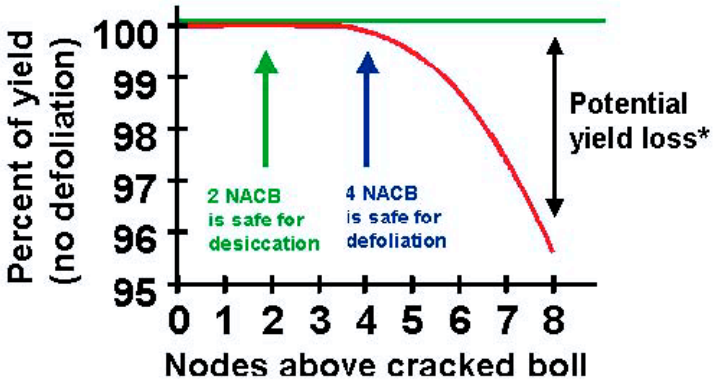


Figure 2. Potential yield loss based on NACB method.



*** when desiccating, add 2 to value for NACB to determine the effect on yield (desiccation at 2 NACB=percent of yield at 4 NACB for defoliation)**

Kerby, Supak, Banks, and Snipes

HARVEST-AID CHEMICAL TYPES

Harvest aids are basically classed in three categories – desiccants, defoliants, and boll openers. Desiccants (paraquat formulations such as Gramoxone SL 2.0, Firestorm, Parazone and various tank-mixes with other products) dry down the plant by causing the cells to rupture. The old "rule of thumb" is that desiccants are normally applied when approximately 80 percent of the productive bolls are open, or at 2-3 nodes above cracked boll. However if sufficient numbers of bolls are mature, based on the knife test, then these chemicals may be applied to somewhat lower percent open boll fields. **Gramaxone SL 2.0, Firestorm, and Parazone are similar products that have paraquat as the active ingredient. The most important difference is in pounds of active ingredient per gallon. Gramoxone SL 2.0 is a 2 lb/gallon formulation, whereas Firestorm and Parazone are 3 lb/gallon products. A conversion table that provides equivalent active ingredient rates in lb/acre for these formulations can be found in the Decision Aid Table section of this publication.** A 24c special local needs (SLN) label has been granted by the Texas Department of Agriculture (TDA) for Gramoxone SL 2.0 and Firestorm. The SLN has approved higher **seasonal use rates** for desiccation of stripper harvested cotton of 48 oz/acre for Gramoxone SL 2.0 and 32 oz/acre for Firestorm. However, the maximum **single use rates** of 31.5 and 21 oz/acre still apply for Gramoxone SL 2.0 and Firestorm, respectively. For Parazone, a maximum **single use rate** of 21 oz/acre and a maximum **seasonal use rate** of 32 oz/acre has been approved and included in the federal label. The SLN labels for Gramoxone SL 2.0 and Firestorm and the federal label for Parazone permitting the higher seasonal use rates include most counties in Texas with the exceptions of Starr, Hidalgo, Willacy and Cameron counties in South Texas. **Paraquat applications made in the late afternoon prior to a bright, sunny day appear to enhance the effectiveness of desiccation and tend to increase regrowth control.** Use of non-ionic surfactant (NIS) at a minimum rate of 0.125% or 0.25% volume/volume (v/v), depending on the % concentration of surface-active agent (see individual product labels) with paraquat is suggested. It may be necessary to increase the NIS rate to 1% v/v and spray late in the day to effectively desiccate some fields. In some years, protoporphyrinogen oxidase (PPO) inhibitor products such as Aim

EC, Display, ET, Sharpen, or Resource (see product descriptions below in the defoliant section) when applied at higher rates work well to desiccate juvenile growth and regrowth, which is many times difficult to accomplish with paraquat.

Defoliants result in initiation of an abscission layer at the base of the leaf petiole where it attaches to the stem. The natural abscission layer formation process is enhanced by the defoliant, which results in leaf drop. When considering mode of action, some defoliants are classified as hormonal and others are herbicidal, and some have mixtures of both. Hormonal defoliants are characterized by enhancing ethylene production or inhibiting auxin transport. Response to these products is generally more sensitive to lower temperatures than herbicidal products. Hormonal type products would include Dropp (thidiazuron) and related products. Herbicidal defoliants would include Folex (tribufos), the PPO inhibitors (Aim, Display, ET, Sharpen, and Resource), and low rates of paraquat or other desiccants (which injure but not kill the leaves). The most commonly used herbicidal defoliant for many years has been Def, but Bayer CropScience discontinued production and sale of Def last year. However, Folex is still available and contains the same active ingredient (tribufos) as Def and performs very similarly. Some products may have mixtures of both hormonal and herbicidal types of activities. These would include Ginstar (thidiazuron plus diuron and related products). In order to obtain maximum leaf drop, defoliants require fairly healthy and active leaves which still properly function and are not severely drought stressed (tough and leathery). Warm air temperatures generally enhance activity. The commonly used rule of thumb is that defoliants can be safely applied when 50-60 percent of the bolls are open and the remaining bolls are of sufficient maturity to obtain desired yield. Although a boll opening response is generally obtained as a result of defoliation, green unopened bolls can still remain a challenge. Many times a follow-up application of paraquat or other chemicals with desiccant activity or a killing freeze is necessary to allow stripper harvest of the crop. Defoliant rates of PPO inhibitor products (Aim EC, Display, ET, Sharpen, and Resource) cause cell membrane disruption which in turn triggers increased ethylene in leaves. High Plains research trials have indicated that the PPO inhibitor products can be effective defoliants, as well as desiccants in some instances when used at higher rates. These products tend to perform fairly similarly, although under certain crop conditions, some may perform better than others. Aim EC, Display, ET, Sharpen and Resource can be tank mixed with other products such as paraquat, Folex, Ginstar, Prep, Finish 6 Pro, and FirstPick. **Use of crop oil concentrate (COC) is suggested for the Aim EC, Display, ET, and Resource spray mixtures and mentholated seed oil (MSO) and an ammonium-based adjuvan is recommended for Sharpen. See specific product labels for details. Failure to follow recommendations with these products will likely result in significantly reduced activity.**

Ethephon based boll-opener products increase the boll opening rate to allow for more rapid harvesting of the crop. Primary ethephon materials include Prep and other related products such as Boll'd, Boll Buster, Setup, and SuperBoll. A few years ago, some enhanced boll opener-defoliant products were marketed. These include Finish 6 Pro and FirstPick which contain both ethephon and the synergists cyclanilide and urea sulfate, respectively). **FirstPick is now being marketed by Nufarm. FirstPick is described as a "water soluble emulsifiable concentrate that has reduced corrosivity and different surfactants" than the older CottonQuik formulation. FirstPick performed similarly to CottonQuik in many trials in the High Plains.** These chemicals affect natural plant processes associated with boll opening, but do not increase the rate of boll or fiber maturation. Once inside the plant, ethephon is converted to ethylene, a plant hormone which increases the rate of abscission layer formation. **Many times, higher rates of ethephon products result in significant defoliation responses, but generally lower rates are used to obtain effective boll opening. The maximum labeled rate for ethephon products is 2 lb a.i./acre.** Defoliant chemicals can be tank mixed with normal use rates of ethephon products to enhance defoliation. The response to ethephon is generally driven

by temperatures. Under warmer conditions, reduced rates of ethephon may be used compared to cooler temperature regimes where higher rates are required to obtain similar plant responses. Ethephon product labels generally state that there should be "sufficient mature unopened bolls present to produce desired crop." Mature bolls are defined as "too hard to be dented when squeezed between the thumb and fingers, too hard to be sliced with a sharp knife, and when the seedcoat becomes light brown in color." **Applications of boll opening products when bolls lack adequate maturity will likely result in reduced lint yield and micronaire. Results from several High Plains studies indicate that reductions occurred when applications were made at 25 percent open bolls, but not at 50 percent open bolls. Lint yields were reduced at least 10 percent, and micronaire was decreased by about 5 percent.** A sequential application of paraquat (or other product with desiccant activity) is generally required to sufficiently condition the crop for stripper harvest.

Glyphosate can be applied as a harvest aid to non-glyphosate tolerant cotton (not Roundup Ready, Roundup Ready Flex or Glytol) varieties or conventional varieties specifically to target weed problems and/or to reduce cotton regrowth potential. Effective silverleaf nightshade (or whiteweed) control can be observed in the following season with application of 1-2 quarts per acre of glyphosate when weeds are in the green-berry stage. Control of severe weed infestations may be increased by the higher rate. Research has shown that reductions in weed populations of up to 97 percent can be obtained from such an application. Applications made in September should target cotton that is 50-80 percent open. After October 1, cotton can be treated when 30 percent of the bolls are open. Allow at least two weeks for maximum glyphosate effectiveness on weeds and cotton and at that time consider a sequential paraquat application to complete conditioning. **Glyphosate should not be applied at this time to non-Roundup Ready Flex fields grown for seed production since viability and/or vigor of seed may be reduced. Regrowth in Roundup Ready and Roundup Ready Flex cotton varieties will not be controlled by glyphosate application, although late season (especially perennial) weed control can be achieved.**

APPLICATION CONSIDERATIONS

In general, the yield and condition of the cotton should determine the type of harvest aid product chosen. If the leaves are beginning to shed and have reddish to purple pigmentation present, they will be easier to drop off the plant without excessive "leaf stick." "Sticking" occurs when the leaves do not drop and are frozen on the plant. The natural abscission layer forming process at the base of the leaf petiole is abruptly halted by physiological stress such as a freeze or desiccant application. Some cotton varieties do not readily form abscission layers even on older leaves and may not defoliate properly. If the leaves "stick," then lint quality can be reduced due to increased leaf content in the fiber. Drought-stressed leaves generally have a much thicker waxy cuticle on the surface. This can considerably affect harvest-aid performance.

Secondary growth (or “regrowth”) sometimes occurs after the plants have "cutout" or stopped blooming due to drought stress or physiological maturity. If warm temperatures and rainfall are encountered at that time, the cotton plant growth cycle can start again, and one can find secondary growth in the terminal and on many of the other nodes on the plant. Plants with unopened bolls or young, developing bolls are less likely to produce secondary growth, although application made at this stage can result in reduced lint quality and yield. Secondary growth is difficult to control since young foliage does not form abscission layers or shed as older leaves do. **Research has shown that, in general, the PPO inhibitor products are effective for desiccating this type of regrowth.**

Proper spray volume and coverage are also critical to the success of a harvest-aid program. Be sure to calibrate the sprayer to deliver the correct volume and nozzle pressure to ensure adequate distribution and foliage penetration. **Read and follow the label directions for use of the product.** The harvest-aid label contains information based on many years of testing and results. **Avoid applying on windy days to reduce the hazard of spray drift to nontarget vegetation.** Some harvest-aid chemicals are very toxic, and should be properly handled and stored, especially around small children and pets.

CHEMICAL SELECTION DECISIONS FOR STRIPPER HARVESTED COTTON

For lower yielding cotton (generally less than 500 lb per acre lint yield) a paraquat-based desiccant should be considered because of reduced expense. A two application program of a low initial rate followed by a higher rate may be appropriate. If the plants are large and have considerable green leaves remaining, sequential applications of low rates of desiccants are sometimes used to promote defoliation and reduce leaf sticking. Use of paraquat-based desiccants should be discouraged when seedling wheat, or other crop species, are in close proximity to targeted cotton fields. **Drift from paraquat can cause severe damage to developing small grains plants grown for cover or harvest.** Unlike with paraquat, drift from desiccant rates of PPO inhibitor products (such as Aim EC or ET and perhaps Sharpen and Resource) should not injure small grains.

For cotton yielding in excess of one bale per acre, other chemicals can be used and the higher cost more easily justified. Ethephon-based products result in an increased rate of boll opening and defoliation that generally reaches a maximum within 14 days. Tank mixes of ethephon and defoliants (such as Folex or Ginstar) are effective in higher yielding cotton to open bolls and drop leaves. Warm temperatures (80º F) are normally required to obtain the maximum boll opening response, although higher rates of ethephon can still be effective under cooler temperature conditions. **Finish 6 Pro has 6 lb ethephon/gallon combined with a proprietary synergist cyclanilide (0.375 lb/gallon).** Cyclanilide is reported to be an effective inhibitor of auxin transport and binding which should result in increased abscission activity. In order to obtain desirable levels of defoliation with Finish 6 Pro, tank mixes with defoliants are many times required. **FirstPick is another ethephon-based product (2.28 lb ethephon/gallon or 18.3 percent a.i.) which has a synergist identified as urea sulfate (58.6 percent a.i.).** Sixteen to 21 oz per acre of ethephon (when using 6-lb/gallon product, equivalent to 0.75-1 lb per acre a.i.) when tank mixed with low rates (3-5 oz per acre) of Ginstar typically result in good defoliation, boll opening response and in many instances good regrowth control. Ginstar is a good defoliant that is also one of the most effective products for controlling regrowth, and it works over a fairly wide range of environmental conditions. Tank mixes of ethephon and Ginstar are fairly expensive, and can be used for boll opening and defoliation of cotton with higher yield potential.

When boll openers and defoliants are used, a follow-up application of paraquat (or other product with desiccant activity) is often required to sufficiently condition the cotton for stripper harvest in the High Plains region. Although this adds more expense to the overall harvest-aid program, it is sometimes necessary in order to complete the season-long earliness investment the producer has made.

CHEMICAL SELECTION DECISIONS FOR SPINDLE PICKER HARVESTED COTTON

For high yielding picker-type varieties, spindle picking may be a good option for some producers. Some recently conducted trials indicate that micronaire values of harvested lint may

be increased by about 0.3 units when spindle picked versus stripper harvested. Harvest efficiency may be somewhat lower with spindle picking, but many fiber properties and gin turnout are generally improved when harvested in a timely manner. Seedcotton remaining in the field after spindle picker harvesting is generally of poor quality, including low micronaire. Selecting harvest aid chemicals for picker harvesting is similar to selecting for stripper harvest in higher yielding cotton. Differences, however, do exist. **These differences include the reduced necessity to remove all green leaves from the plant and elimination of the need for sequential applications of paraquat for crop conditioning**. Furthermore, some immature unopened bolls may not be a concern, as these bolls will most likely not make it to the harvester basket and those that do could contribute to lower micronaire. When spindle picking high yielding cotton, greater expense for harvest aids can be justified with greater returns. **Rapid boll opening and defoliation are the objectives when considering harvest aid chemicals for spindle picking. This will allow quicker harvesting with reduced risk from High Plains meteorological events.** Tank mixes of ethephon (including enhanced ethephon products such as Finish 6 Pro and FirstPick) and defoliants (such as Folex or Ginstar) are effective in higher yielding cotton to hasten boll opening and drop leaves.

LATE SEASON INSECT MANAGEMENT AND REDUCTION OF STICKY COTTON POTENTIAL

Sticky cotton problems plagued the High Plains a few years ago, and mills were reluctant to purchase contaminated bales. During fiber laydown at the mill, one contaminated bale can affect as many as 25 to 50 other bales, resulting in increased maintenance and cleaning costs, more down time, and considerable financial losses for the mill. This problem results in a backlash by the mills, reducing the marketability of High Plains cotton. Lack of commercial testing equipment for determining "sticky" bales results in boycotting of the region's cotton by most mills. High Plains producers have come a long way in improving the reputation of the region's cotton due to the introduction of higher strength, longer staple varieties. Sticky cotton concerns are still with us and in order to preserve the hard-earned reputation of good quality, measures should be taken by producers to reduce the potential of the problem. Late season aphid buildups and resultant honeydew-derived sticky cotton can and should be reduced by insecticide applications and timely chemical termination of the crop. Refer to the section on crop maturity determination for more information. Dryland producers should consider using low-cost desiccants such as paraquat-based products on fields that experience premature cutout due to drought. Short plants with low yield potential and 80 percent open bolls (or when two to three unopened first position bolls are above the uppermost first position cracked boll -also called nodes above cracked boll) can usually be terminated using paraquat. **Significant amounts of honeydew and dust on leaves can reduce the effectiveness of paraquat-based products**. Producers of irrigated cotton should carefully watch the maturity of their crop. When an adequate percentage of mature bolls is reached, defoliants and boll openers should be applied. Timely termination of irrigated fields will greatly reduce the leaf area necessary for aphids to feed and produce honeydew, thus reducing the potential for sticky cotton problems in harvested lint.

2012 HIGH PLAINS COTTON HARVEST-AID DECISION TABLE
NOT ALL TREATMENTS ARE EQUALLY EFFECTIVE
RATES LISTED ARE UNITS OF PRODUCT PER ACRE

CROP CONDITION	DRY TEMPERATURES GREATER THAN 80° F (0-3 DAYS AFTER TREATMENT)	DRY TEMPERATURES LESS THAN 80° F (0-3 DAYS AFTER TREATMENT)	WET TEMPERATURES LESS THAN 75° F (0-3 DAYS AFTER TREATMENT)
HEIGHT: Short 12-14 inches **YIELD:** up to 500 lb/acre	Gramoxone SL 2.0 8-16 oz[1]	Gramoxone SL 2.0 8-16 oz[1]	Gramoxone SL 2.0 8-16 oz[1]
	Firestorm or Parazone 5.3-10.7 oz[1]	Firestorm or Parazone 5.3-10.7 oz[1]	Firestorm or Parazone 5.3-10.7 oz[1]
	Gramoxone SL 2.0 4-8 oz followed by (FB) Gramoxone SL 2.0 up to 48 oz total[2]	Gramoxone SL 2.0 8-12 oz FB Gramoxone SL 2.0 up to 48 oz total[2]	Gramoxone SL 2.0 8-12 oz FB Gramoxone SL 2.0 up to 48 oz total[2]
	Firestorm or Parazone 2.6-5.3 oz FB Firestorm up to 32 oz total[2] or Parazone up to 32 oz total[3]	Firestorm or Parazone 2.6-5.3 oz FB Firestorm up to 32 oz total[2] or Parazone up to 32 oz total[3]	Firestorm or Parazone 2.6-5.3 oz FB Firestorm up to 32 oz total[2] or Parazone up to 32 oz total[3]
	Gramoxone SL 2.0 6-10 oz + defoliant/desiccant[4]	Gramoxone SL 2.0 8-12 oz + defoliant/desiccant[4]	Gramoxone SL 2.0 10-24 oz + defoliant/desiccant[4]
	Firestorm or Parazone 4-6.7 oz + defoliant/desiccant[4]	Firestorm or Parazone 5.3-8 oz + defoliant/desiccant[4]	Firestorm or Parazone 6.7-16 oz + defoliant/desiccant[4]
	Ginstar 6-8 oz banded	Ginstar 8 oz banded	Ginstar 8-10 oz banded
	Aim EC 1 oz + COC with or without defoliant/desiccant	Aim EC 1 oz + COC with or without defoliant/desiccant	Aim EC 1 oz + COC with or without defoliant/desiccant
	Aim EC 1 oz + COC FB Aim EC 1 oz + COC[5]	Aim EC 1 oz + COC FB Aim EC 1 oz + COC[5]	Aim EC 1 oz + COC FB Aim EC 1 oz + COC[5]
	ET 1.5-2 oz + COC with or without defoliant/desiccant	ET 1.5-2 oz + COC with or without defoliant/desiccant	ET 1.5-2 oz + COC with or without defoliant/desiccant
	ET 1.5-2 oz + COC FB ET 1.5-2 oz + COC[5]	ET 1.5-2 oz + COC FB ET 1.5-2 oz + COC[5]	ET 1.5-2 oz + COC FB ET 1.5-2 oz + COC[5]
	Display 1 oz + COC with or without defoliant/desiccant	Display 1 oz + COC with or without defoliant/desiccant	Display 1 oz + COC with or without defoliant/desiccant
	Display 1 oz + COC FB Display 1 oz + COC[5]	Display 1 oz + COC FB Display 1 oz + COC[5]	Display 1 oz + COC FB Display 1 oz + COC[5]
	Resource 6-8 oz + COC FB Resource 4-6 oz + COC[5]	Resource 6-8 oz + COC FB Resource 4-6 oz + COC[5]	Resource 6-8 oz + COC FB Resource 4-6 oz + COC[5]
	Sharpen 1 oz + MSO + AMS with or without defoliant/desiccant	Sharpen 1 oz + MSO + AMS with or without defoliant/desiccant	Sharpen 1 oz + MSO + AMS with or without defoliant/desiccant
	Sharpen 1 oz + MSO + AMS FB Sharpen 1 oz + MSO + AMS[5]	Sharpen 1 oz + MSO + AMS FB Sharpen 1 oz + MSO + AMS[5]	Sharpen 1 oz + MSO + AMS FB Sharpen 1 oz + MSO + AMS[5]

2012 HIGH PLAINS COTTON HARVEST-AID DECISION TABLE (continued)
NOT ALL TREATMENTS ARE EQUALLY EFFECTIVE
RATES LISTED ARE UNITS OF PRODUCT PER ACRE

CROP CONDITION	DRY TEMPERATURES GREATER THAN 80° F (0-3 DAYS AFTER TREATMENT)	DRY TEMPERATURES LESS THAN 80° F (0-3 DAYS AFTER TREATMENT)	WET TEMPERATURES LESS THAN 75° F (0-3 DAYS AFTER TREATMENT)
HEIGHT: Medium 15-24 inches **YIELD: 500+ lb/acre**	**FOR TREATMENTS LISTED BELOW, A SEQUENTIAL APPLICATION OF PARAQUAT (OR OTHER DESICCANT ACTIVITY PRODUCT) 10-14 DAYS AFTER INITIAL TREATMENT WILL LIKELY BE NECESSARY TO SUFFICIENTLY CONDITION CROP**		
	Gramoxone SL 2.0 6-10 oz[1] + defoliant/desiccant[4]	Gramoxone SL 2.0 8-12 oz[1] + defoliant/desiccant[4]	Gramoxone SL 2.0 10-24 oz[1] + defoliant/desiccant[4]
	Firestorm or Parazone 4-6.7 oz[1] + defoliant/desiccant[4]	Firestorm or Parazone 5.3-8 oz[1] + defoliant/desiccant[4]	Firestorm or Parazone 6.7-16 oz[1] + defoliant/desiccant[4]
	Gramoxone SL 2.0 4-8 oz followed by (FB) Gramoxone SL 2.0 up to 48 oz total[2]	Gramoxone SL 2.0 6-8 oz FB Gramoxone SL 2.0 up to 48 oz total[2]	–
	Firestorm or Parazone 2.6-5.3 oz FB Firestorm up to 32 oz total[2] or Parazone up to 32 oz total[3]	Firestorm or Parazone 4-5.3 oz FB Firestorm up to 32 oz total[2] or Parazone up to 32 oz total[3]	–
	Ginstar 6-8 oz	Ginstar 8 oz	Ginstar 8-10 oz
	Aim EC 1 oz + COC + defoliant/desiccant	Aim EC 1 oz + COC + defoliant/desiccant	Aim EC 1 oz + COC + defoliant/desiccant
	Aim EC 1 oz + COC FB Aim EC 1 oz + COC[5]	Aim EC 1 oz + COC FB Aim EC 1 oz + COC[5]	Aim EC 1 oz + COC FB Aim EC 1 oz + COC[5]
	ET 1.5-2 oz + COC with or without defoliant/desiccant	ET 1.5-2 oz + COC with or without defoliant/desiccant	ET 1.5-2 oz + COC with or without defoliant/desiccant
	ET 1.5-2 oz + COC FB ET 1.5-2 oz + COC[5]	ET 1.5-2 oz + COC FB ET 1.5-2 oz + COC[5]	ET 1.5-2 oz + COC FB ET 1.5-2 oz + COC[5]
	Display 1 oz + COC with or without defoliant/desiccant	Display 1 oz + COC with or without defoliant/desiccant	Display 1 oz + COC with or without defoliant/desiccant
	Display 1 oz + COC FB Display 1 oz + COC[5]	Display 1 oz + COC FB Display 1 oz + COC[5]	Display 1 oz + COC FB Display 1 oz + COC[5]
	Resource 6-8 oz + COC FB Resource 4-6 oz + COC[5]	Resource 6-8 oz + COC FB Resource 4-6 oz + COC[5]	Resource 6-8 oz + COC FB Resource 4-6 oz + COC[5]
	Sharpen 1 oz + MSO + AMS with or without defoliant/desiccant	Sharpen 1 oz + MSO + AMS with or without defoliant/desiccant	Sharpen 1 oz + MSO + AMS with or without defoliant/desiccant
	Sharpen 1 oz + MSO + AMS FB Sharpen 1 oz + MSO + AMS[5]	Sharpen 1 oz + MSO + AMS FB Sharpen 1 oz + MSO + AMS[5]	Sharpen 1 oz + MSO + AMS FB Sharpen 1 oz + MSO + AMS[5]
	Prep 16 oz + Ginstar 3-5 oz	Prep 16-21 oz[6] + Ginstar 3-5 oz	Prep 21 oz[6] + Ginstar 3-5 oz
	Prep 16-21 oz + Folex 8-16 oz	Prep 16-21 oz6 + Folex 16 oz	Prep 21 oz[6] + Folex 16 oz
	Prep 16-21 oz + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC OR + Sharpen 1 oz + MSO + AMS	Prep 16-21 oz[6] + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS	Prep 21 oz[6] + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS
	Finish 6 Pro 21 oz + defoliant (Folex 8 oz or Ginstar 3-5 oz)	Finish 6 Pro 21-32 oz[6] (defoliant may be required)	Finish 6 Pro 21-42 oz[6] (defoliant may be required)
	FirstPick 3 pts + Ginstar 3 oz	FirstPick 3-4 pts[6] + Ginstar 5 oz	FirstPick 4 pts[6] + Ginstar 6-8 oz

2012 HIGH PLAINS COTTON HARVEST-AID DECISION TABLE (continued)
NOT ALL TREATMENTS ARE EQUALLY EFFECTIVE
RATES LISTED ARE UNITS OF PRODUCT PER ACRE

CROP CONDITION	DRY TEMPERATURES GREATER THAN 80° F (0-3 DAYS AFTER TREATMENT)	DRY TEMPERATURES LESS THAN 80° F (0-3 DAYS AFTER TREATMENT)	WET TEMPERATURES LESS THAN 75° F (0-3 DAYS AFTER TREATMENT)
HEIGHT: **Tall** Greater than 24 inches **YIELD:** 1000+ lb/acre	**FOR TREATMENTS LISTED BELOW, A SEQUENTIAL APPLICATION OF PARAQUAT (OR OTHER DESICCANT ACTIVITY PRODUCT) 10-14 DAYS AFTER INITIAL TREATMENT WILL LIKELY BE NECESSARY TO SUFFICIENTLY CONDITION CROP**		
	Prep 21 oz + Folex 8-16 oz	Prep 21 oz + Folex 16 oz	Prep 21-28 oz6 + Folex 16 oz
	Finish 6 Pro 21 oz + defoliant (Folex 8 oz or Ginstar 3-5 oz)	Finish 6 Pro 21-32 oz6 + defoliant (Folex 8-10 oz or Ginstar 4-6 oz)	Finish 6 Pro 32-42 oz6 + defoliant (Folex 8-10 oz or Ginstar 6-8 oz)
	Finish 6 Pro 21 oz + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS	Finish 6 Pro 21-32[6] oz + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS	Finish 6 Pro 32-42[6] oz + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 0z + MSO + AMS
	Prep 21 oz + Ginstar 3-5 oz	Prep 21-24 oz[6] + Ginstar 4-6 oz	Prep 24-32[6] oz + Ginstar 6-8 oz
	Prep 21 oz + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS	Prep 21-24 oz[6] + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS	Prep 24-32[6] oz + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS
	FirstPick 3-4pts + Ginstar 3-5 oz	FirstPick 4-5 pts[6] + Ginstar 6-8 oz	FirstPick 6-7pts[6] + Ginstar 6-8 oz
	FirstPick 3-4 pts + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS	FirstPick 4-5 pts[6] + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS	FirstPick 6-7 pts[6] + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS
	Ginstar 6-8 oz	Ginstar 8 oz	Ginstar 8-10 oz
LATE MATURING	**CONDITIONING TREATMENT ONLY (Apply after daily heat units drop below 5, but 7 days before average first killing freeze date)**		
	Gramoxone SL 2.0 4-8 oz	Gramoxone SL 2.0 6-12 oz	Gramoxone SL 2.0 10-16 oz
	Firestorm or Parazone 2.6-5.3 oz	Firestorm or Parazone 4-8 oz	Firestorm or Parazone 6.7-10.7 oz
	Prep 21-24 oz	Prep 21-32 oz[6]	Prep 32-42 oz[6]
	Prep 21-24 oz + Folex 8 oz or + Ginstar 8 oz or + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS	Prep 21-32 oz[6] + Folex 8 oz or + Ginstar 8 oz or + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS	Prep 24-32 oz[6] + Folex 16 oz or + Ginstar 8-16 oz or + Aim EC 1 oz + COC or + Display 1 oz + COC or + ET 1.5 oz + COC or + Resource 6-8 oz[5] + COC or + Sharpen 1 oz + MSO + AMS

FOOTNOTES

FB=Followed by

[1]- Use on cotton with natural leaf shed. High rates can cause green, healthy leaves to stick. Always use a non-ionic surfactant when applying paraquat-based products (Gramoxone SL 2.0, Firestorm, Parazone). There is some concern for the single high dose rate on hairy-leaf cotton varieties. Poor leaf grades may be obtained. Make sure the cotton has 80% open bolls at application, use enough paraquat to completely kill all foliage, then stripper harvest only when leaves are dry enough to "crunch" when crushed by hand. Avoid stripper harvesting moist, dead leaves or high leaf grades may be encountered.

[2]-No more than 48 oz/acre total of Gramoxone SL 2.0 or no more than 32 oz/acre total of Firestorm may be applied (in up to 3 multiple applications) in one season based on the Texas Special Local Need 24c label. The need for and rate of Gramoxone SL 2.0 or Firestorm in a second application will depend upon green leaves remaining. Use higher rates if regrowth is excessive.

[3]-No more than 32oz/acre total of Parazone may be applied (in up to 3 multiple applications) in one season based on the current label. The need for and rate of Parazone in a second application will depend upon green leaves remaining. Use higher rates if regrowth is excessive.

[4]-Tankmix partners with Gramoxone SL 2.0, Firestorm, or Parazone can include sodium chlorate, Folex, Aim, Display, ET, and Resource.

[5]-No more than: 3.2 oz/acre total of Aim 2EC, 2.0 oz/acre total of Display, 2.0 oz/acre total of Sharpen, 5.5 oz/acre total (in no more than 2 applications) of ET, and 14 oz/acre (in no more than 2 applications with a maximum of 8 oz/acre per single application) of Resource may be applied during the growing season.

[6]-Ethephon-based product (such as Finish 6 Pro, FirstPick, Prep, Super Boll, Boll'd, Boll Buster, and Setup) activity is determined by rate and temperature. At lower temperatures, boll opening response can be enhanced by increasing rate.

Conversion Table for Gramoxone SL 2.0, and Firestorm and Parazone for Equivalent Paraquat Active Ingredient Rates

Paraquat (Active Ingredient) Lb/Acre	GRAMOXONE SL 2.0 (2 LB/GAL)		FIRESTORM and PARAZONE (3 LB/GAL)	
	Product Oz / Acre	Approximate Acres/Gal	Product Oz / Acre	Approximate Acres/Gal
0.0625	4	32	2.6	48
0.0938	6	21.3	4	32
0.1250	8	16	5.3	24
0.1563	10	12.8	6.7	19
0.1870	12	10.7	8	16
0.2500	16	8	10.7	12
0.3750	24	5.3	16	8
0.5000	32	4	21.3	6
0.7500	48	2.7	32	4

Brand Names and Similar Products

COMMONLY USED	SIMILAR PRODUCT
Prep (ethephon, 6 lb/gal)	Boll'd (Agrisolutions) Boll Buster (Loveland Products) Ethephon-6 (Arysta Lifescience) Flash (3 lb/gal, Helena) Setup 6SL (MANA) Super Boll (Nufarm)
Ginstar EC (thidiazuron + diuron)	Adios (Arysta Lifescience) Cutout (Nufarm) Redi-Pik 1.5EC (MANA)
Dropp SC (thidiazuron - not normally used in the High Plains due to low termperature sensitivity)	Daze 4SC (Agrisolutions) FreeFall SC (Nufarm) Klean-Pik (MANA) Take Down SC (Loveland Products)
Folex (Amvac)	