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W225-Cotton Harvest Aids

The University of Tennessee Agricultural Extension Service

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Cotton Harvest Aids

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Defoliation is the shedding of cotton leaves that usually occurs when the 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 can be caused by a light frost, disease, drought or mineral deficiency. It also can be artificially induced by the use of certain chemicals called "defoliants." In situations where canopies are dense and there are significant numbers of green bolls that need to be opened, two applications are often needed. Often, you should plan for a two-pass approach instead of getting less than desirable results from an expensive one-shot approach requiring a second application to finish removing leaves. The goal of the first application is to remove as much foliage as possible, exposing the unopened bolls without causing desiccation.

Desiccation is drying of plant tissues due to disruption of cell membranes and rapid loss of moisture, often resulting in "stuck leaves." The second harvest aid application will require additional defoliant to finish removing leaves but, more importantly, adequate boll opener to stimulate boll opening. Product selection and rates should be changed to match environmental conditions as they change during the harvest season.

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 harvest earlier in the season
- Quicker drying of dew, allowing picking earlier in the day
- Reducing moisture
- Improving storage in modules

Application Timing and Conditions

Weather – Weather conditions at the time of application and for three to five days following application have a great effect on the response to harvest aids. Harvest aids are most active when temperature, sunlight intensity and relative humidity are high. A night temperature above 60 degrees F is especially important. For temperatures above 60 degrees F, the percentage of leaves that drop and the speed of leaf drop roughly doubles for each 10-degree rise in temperature. At least a full day of clear weather following application is needed for best results.

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Plant Conditions – Defoliation is best in mature, well-fruited, uniform plants that have 'cutout' but are not completely inactive. The nutrient supply, particularly nitrogen, should be almost exhausted, and the crop should not be under drought stress. Results may be poor when defoliants are applied to drought-stressed crops with tough foliage.

Application timing:

The single most important factor to consider in timing defoliant application is boll maturity. Little or no boll maturation occurs after the leaves are removed. Premature leaf removal can reduce yield and quality. It is generally safe to defoliate when 50-60 percent of the bolls are opened and the youngest bolls are mature. Under high levels of management, this may occur when 45 percent of the bolls are opened. To check boll maturity, cut the uppermost harvestable boll in cross section with a sharp knife. When the boll is mature, it should be difficult to cut with a sharp knife, the seed will be completely filled out and there is no jelly in the center. The presence of a thin brown line around the seed indicates the seed coat is reaching maturity; the boll is mature enough not to be adversely affected by application of a harvest-aid chemical. When possible, apply defoliants in late afternoon or early morning when humidity is high and winds are calm. The crop is ready to treat when the top-most, first-position harvestable boll is four nodes or less above the uppermost, first-position cracked boll (NACB).

Some defoliation materials do not move within the plant, so coverage is important. Cone-type nozzles are superior to flat-fan, air-inducted nozzles for good foliar coverage with ground spray machines. Two equally spaced hollow-cone nozzles per row should give adequate coverage. Spray pressure, ground speed and nozzles should be matched to apply a finished spray rate in accordance with label instructions. A second application of a defoliant may be required for defoliation of rank cotton. Consult the product label for rates and other information.

Other factors to consider when defoliating:

Do not defoliate all cotton at one time. Defoliants 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 in three to four hours after application of a defoliant does not destroy effectiveness of these chemicals except Dropp™, which requires 24 hours before rain.

Types of Defoliants:

Defoliants can be categorized as having either herbicidal or hormonal activity. Def™, Folex™, Harvade™, Aim™ and ET™ are herbicidal-type defoliants that injure the plant, causing it to produce ethylene in response to this injury. The ethylene promotes abscission and leaf drop. If these defoliants are applied at rates too high for the temperature, they kill the leaf too quickly before ethylene can be produced. This results in desiccation or "leaf stick" instead of the desired defoliation (leaf drop). Dropp, FreeFall™, Finish™, First Pick™ and PrepTM are hormonal defoliants that result in increased ethylene synthesis by the plant. Prep releases ethylene, which stimulates further ethylene synthesis in the plant, resulting in abscission zone formation in the boll walls and leaf petioles. Dropp is a type of hormone called a cytokinin. Although cytokinins promote leaf health in most plant species, in cotton and related species such as velvetleaf, cytokinins promote ethylene synthesis and act as a defoliant. Because these hormonal-type defoliants bypass herbicidal injury, they are not as likely to cause desiccation (leaf stick) as herbicidal defoliants.

Herbicidal Defoliants:

Def and Folex: These phosphate-type materials have been the standard defoliants in Tennessee for several years. Their performance is essentially equal and they are effective over a broad range of environment conditions. Minimum temperature for optimum performance is 55-60 degrees F. These materials do not inhibit re-growth or appreciably improve boll opening. Activity improves with increased maturity of the crop. Leaf removal with each of these products is usually rapid and addition of surfactants offers benefit only under adverse conditions. One thing is certain – both products have a pungent odor.

Labeled Rates: 16—32 oz per acre

Harvade: Harvade has generally provided defoliation of mature cotton equal to Def and Folex, but is usually slower. Harvade does not inhibit re-growth or improve boll opening. Addition of crop oil concentrate (1 pt./A) is necessary for acceptable defoliation. Addition of Harvade will increase desiccation of morningglories and other viney weeds. Harvade has very little odor.

Labeled Rates: 8-10 oz per acre

Ginstar™: Ginstar is an emulsifiable concentrate formulation of thidiazuron (active ingredient in Dropp and FreeFall) and diuron (Karmex, Direx). It is applied to mature cotton at least five days before harvest, but defoliation may take longer under cool conditions. Addition of adjuvants or excess rates can cause desiccation or "stuck leaves" under warm conditions. The Ginstar label does not discuss tank mixtures, but tank mixtures with ethephon have enhanced boll-opening activity.
Labeled Rates: 6.4—16 oz per acre

Paraquat (Gramoxone Inteon™): Paraquat can aid in opening of mature bolls when 2.1 to 3.3 oz./A are mixed with Def, Folex, Dropp, Harvade or Ethephon. Development of immature bolls will be inhibited by paraquat application.
Labeled Rates: 3.0—11.25 oz per acre

Leafless™: Leafless is a combination of thidiazuron (Dropp) and dimethipin (Harvade). It combines the benefits of dimethipin listed above with good to excellent re-growth inhibition, and removal of juvenile growth provided by thidiazuron. Limited research has also shown that split applications of Leafless are effective in defoliating rank cotton. The recommended rate of 10-12 ounces per acre delivers the equivalent of 0.125-0.15 lbs. Dropp/Freefall and 6.7-7.7 ounces per acre Harvade. If morningglory desiccation is desired, additional Harvade and Prep will be required. Crop oil concentrate at 0.5 to 1.0 pints per acre should be added to Leafless.
Labeled Rates: 10—12 oz per acre

Aim: Aim has excellent activity in desiccation of juvenile growth, but does not inhibit re-growth. In mature cotton, and/or cool conditions, Aim activity has been shown to be similar to Def or Folex. In warm conditions, however, less-than-desirable defoliation and excessive desiccation have been shown with Aim. In situations in which two applications are necessary, Aim has performed very well as the second application. Aim has shown excellent activity in desiccating morningglories. In situations with thick vines, Aim alone or in combination with other defoliants will desiccate morningglories very well. Aim can be tank-mixed with any of the other defoliants, and the addition of 1% v/v crop oil is needed.
Labeled Rates: 1—1.5 oz per acre

ET: ET has excellent activity in 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 Def or Folex. In warm conditions, however, less-than-desirable defoliation and excessive desiccation have been shown 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 any of the other defoliants, and the addition of 0.5-1.0% v/v crop oil is needed.
Labeled Rates: 1.5-2.75 oz per acre

Glyphosate (many formulations): Glyphosate provides excellent re-growth 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 aide.
Labeled Rates: 13–51 oz per acre for weed and re-growth control in non-RR cotton

Hormonal Defoliants and Boll Opening Materials:

Dropp: (Dropp 50WP, FreeFall): These thidiazuron products are formulated as a wettable powder. They require a 24-hour rainfree period and are also sensitive to cool weather. Dropp should not be applied when the average 24-hour temperature is predicted to be below 60 degrees F for two to three days after application. Dropp is slower in leaf removal than Def or Folex and may leave some bottom leaves. Dropp effectively removes younger leaves at the shoot tips. Dropp does not improve boll opening; however, Dropp will strongly inhibit re-growth when applied under favorable weather conditions. If Dropp is used under less-than-favorable conditions, the addition of crop oil concentrate (1 pt./A) may enhance the activity of this material. It is important to follow suggested cleanout procedures with Dropp or FreeFall.
Labeled Rates: 0.1—0.4 lb ai per acre

Finish 6 Pro: Finish contains ethephon and the synergist cyclanilide that aids in defoliation. Finish is an excellent boll opener and can be a stand-alone product in cooler temperatures and well-cutout situations. Finish also exhibits a limited level of re-growth control. Finish is generally a faster boll opener than ethephon and can be tank-mixed with thidiazuron, phosphate materials and Ginstar.

FirstPick: FirstPick also contains the boll opener ethephon and a synergist, urea sulfide. It is an excellent boll opener. Acceptable defoliation with FirstPick alone requires mature cotton with mature leaves. In cases of rank growth, or the potential for re-growth, the addition of Dropp, Freefall, Def or Folex is recommended.

Desiccants:

Sodium Chlorate: More than one brand of sodium chlorate may be 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 defoliants. It is not a strong inhibitor of terminal growth. Do not mix the chlorates with phosphate defoliants, phosphate insecticides or Prep.

Paraquat (Gramoxone Inteon): Use higher rates for desiccation of weeds and for stripper-harvested cotton.

Defoliating Drought-Stressed and Rank Cotton:

Drought-stressed cotton often has thick cuticles and leathery leaves that inhibit the uptake of many defoliants. The potential for re-growth is often high due to unused nitrogen remaining after premature cutout. The uptake of Dropp or Freefall appears to be slightly inhibited in drought-stressed cotton and higher rates may be needed. Leafless and Ginstar both deliver a liquid form of thidiazuron and limited research suggests that their uptake may be less affected by drought-stressed cotton than Dropp or Freefall. Tank mixtures with Def or Folex, as well as the addition of silicone surfactants or ammonium sulfate, have been shown to increase the uptake of Dropp or Freefall on drought-stressed cotton. However, use caution when applying higher rates or adjuvants in warmer weather, as desiccation and stuck leaves may result.

Obtaining adequate 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 because most spray solution is intercepted there. In rank situations, the best approach is to apply normal rates, keeping in mind that a second application is likely to be necessary. Rank cotton is generally more expensive to defoliate than normal cotton. However, if a good job is done on the first application, the second application may not require the high rates or complex tank mixes. Additionally, a boll opener can be more effective if added to the second application.

Drought-stressed cotton has thicker cuticles that limit the penetration of some products. In high temperatures, combinations of herbicidal-type defoliants may desiccate leaves. Re-growth is often a problem if rainfall occurs following application. Re-growth can be a concern with applications of Def or Folex alone or tank-mixed with ethephon, depending on moisture conditions and temperature following application. Activity of most defoliants is reduced under cooler conditions, and higher rates will be needed. Re-growth is generally not as big a concern as with warmer temperatures. Boll openers should be added to all treatments to ensure boll opening in the event 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 injury or loss of stand with the wheat crop.

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

Harvest Aid	*Small Grain Re-crop Interval*
Def 6	***None***
Folex 6	***None***
Harvade 5F	***6 months***
Ginstar	***1 month***
Leafless	***6 months***
Aim	***None***
ET	***None***
Dropp SC	***14 days***
Freefall	***14 days***
Finish 6 Pro	***1 month***
FirstPick	***30 days***
Glyphosate	***None***
Ethephon	***30 days***
Gramoxone Inteon	***None***
Sodium Chlorate	***None***

Table 2. Use pattern and expected activity for defoliants and dessicants.

Harvest aid[1]	**Labeled broadcast rate/acre**	**Max. use per season**	**Rainfree period (hours)[2]**	**Pre-harvest interval (Days)**	**Estimated min. temp.**	**Mature leaves**	**Juvenile growth**	**Re-growth prevention**	**Boll opening**
Def 6	16-24 oz	24 oz	1	7	60 F	Excellent	Fair	Poor	***None***
Folex 6	16-24 oz	24 oz	1	7	60 F	Excellent	Fair	Poor	***None***
Harvade 5F	8-10 oz	14 oz	6	7	55 F	Excellent	Fair	Poor	***None***
Ginstar	6.4-16 oz	16 oz	12	5	60 F	Excellent	Excellent	Excellent	***None***
Leafless	10-12 oz	20 oz	24	7	65 F	Excellent	Excellent	Excellent	***None***
Aim	0.5-1.6 oz	3.2 oz	8	7	55 F	Excellent	Excellent	Poor	***None***
ET	1.5-2.0 oz	5.5 oz	1	7	55 F	Excellent	Excellent	Poor	***None***
Dropp SC	1.6-3.2 oz	9.6 oz	24	5	65 F	Excellent	Excellent	Excellent	***None***
Freefall	0.1-0.2 #	0.6 #	24	5	65 F	Excellent	Excellent	Excellent	***None***
Finish 6 Pro	21-42 oz	42 oz	6	7	60 F	Excellent	Poor	Fair	Excellent
FirstPick	96-112 oz	112 oz	N/A	7	60 F	Excellent	Poor	Poor-Fair	Excellent
Glyphosate[3]			4	7	55 F	Fair	Fair	Excellent	***None***
Ethephon	21-42 oz	42 oz	6	7	60 F	Fair	Poor	Poor	Excellent
Desiccants									
Gramoxone Inteon	None	21	30 min.	3	55 F	Fair	Excellent	Poor	***Fair***
Sodium Chlorate	4.5 # ai	N/A	24	7	55 F	Fair	Fair	Poor	***None***

[1]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.
[2]Expected temperature ranges 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.
[3]Non-glyphosate tolerant varieties only.

Table 3. Preconditioning harvest aid products and use rates.

Treatment	Early season: Highs in 90s, Lows in 70s	Mid season: Highs in 70s, Lows in 50s	Late season: Highs in 60s, Lows in 40s	Remarks
		Product per acre		
Def/Folex	4-6 oz	6-8 oz	8-16 oz	Addition of low rates of ethephon will increase activity of Def/Folex
Ethephon (Prep, Superboll, Ethephon 6)	8-16 oz	16-21 oz	21-24	Addition of low rates Def/Folex of will increase activity of ethephon
Aim	0.5 oz + 0.25% NIS	0.5-0.75 oz + 0.25% NIS	0.75-1.0 oz + 0.5 v/v COC	Using NIS instead of COC may reduce desiccation; tank mixes with ethephon containing products and sequential applications have shown best results
ET	1.5 oz + 0.5% COC	1.5oz + 1 % COC	2.0 oz + 1.0 % COC	Higher rates may increase desiccation during hot temperatures; tank mixes with ethephon containing products and sequential applications have shown best results
Harvade	8 oz + 1 pt. COC	8 oz + 1 pt. COC	8 oz + 1 pt. COC	Addition of low rates of ethephon will increase activity
Finish 6 Pro	8-12 oz	12-16 oz	16-21 oz	Addition of low rates of Def/Folex, Aim or ET may help defoliation
Dropp SC Freefall 50WP	1.6-2.4 oz SC 0.1-0.15 # 50 WP	1.6-3.2 oz SC 0.1-0.2 # 50 WP	Do Not Use	Addition of COC may increase uptake and activity; higher rates can lead to desiccation in warm temperatures

Table 4. Harvest aid products for cotton defoliation.

Treatment	Early season: Highs in 90s, Lows in 70s	Mid season: Highs in 70s, Lows in 50s	Late season: Highs in 60s, Lows in 40s	Remarks
		Product per acre		
Def/Folex	6-8 oz	8-12 oz	12-24 oz	Higher rates and lush growth may lead to increased desiccation
Aim	0.5-0.75 oz + 0.25% NIS	0.5-0.75 oz + 0.25% NIS	1.0-1.6 oz + COC	Using NIS instead of COC may reduce desiccation; tank mixes with ethephon containing products and sequential applications have shown best results
ET	0.5 oz + 0.25% NIS	0.5-0.75 oz + 0.25% NIS	0.75-1.0 oz + 0.5 v/v COC	Higher rates may increase desiccation during hot temperatures; tank mixes with ethephon containing products and sequential applications have shown best results
Harvade	8 oz + 1 pt. COC	8 oz + 1 pt. COC	8 oz + 1 pt. COC	Tank mixes with Def/Folex may increase activity
Dropp SC or Freefall 50 WP	1.6-2.4 oz or 0.1-.15 lb	1.6-3.2 oz or 0.1-0.2 lb	Do Not Use	Addition of COC may increase uptake and activity; higher rates can lead to desiccation in warm temperatures
Def/Folex + Dropp SC	6-8 oz + 1.6-2.4 oz	8-12 oz + 1.6-3.2 oz	12-24 oz + 1.6-3.2 oz	For maximum re-growth control, use a minimum of 2.4 oz Dropp SC or 0.15# Freefall 50WP
Aim + Dropp SC	0.5-0.75 oz + 1.6-2.4 oz + 0.25% NIS	0.5-1.0 oz + 1.6-3.2 oz + 0.25% NIS	1.0-1.6 oz + 1.6-3.2 oz + COC 1% v/v	Higher rates of Aim may lead to desiccation; the herbicidal nature of Aim may lead to decreased activity of Dropp/Freefall
ET + Dropp SC	1.5 oz + 1.6-2.4 oz + 0.5% COC	1.5-2.0 oz + 1.6-3.2 oz + 0.5% COC	2.0 oz + 1.6-3.2 oz + 0.5% COC	Higher rates of ET may lead to desiccation; the herbicidal nature of ET may lead to decreased activity of Dropp/Freefall
Harvade + Dropp SC	8 oz + 1.6-2.4 oz + 1 pt. COC	8 oz + 1.6-3.2 oz + 1 pt. COC	8 oz + 1.6-3.2 oz + 1 pt. COC	For maximum re-growth control, use a minimum of 2.4 oz Dropp SC or 0.15# Freefall 50WP
Ginstar	6.4 oz	6.4-8.0 oz	6.4-10 oz	Higher rates and lush growth may lead to increased desiccation; use at least 6.4 oz for maximum re-growth control

Table 5. Treatment combinations of harvest aids for defoliation and boll opening.

Treatment	Early season: Highs in 90s, Lows in 70s	Mid season: Highs in 70s, Lows in 50s	Late season: Highs in 60s, Lows in 40s	Remarks
		Product per acre		
Def/Folex + Ethephon	4-6 oz + 21-32 oz	6-8 oz + 21-32 oz	8-16 oz + 32-40 oz	Increased rates of ethephon in tank mix will increase activity of Def/Folex in warm conditions. Def/Folex rates may need to be adjusted downward if more than 32 oz ethephon are used.
Aim + Ethephon	0.5-0.75 oz + 21-32 oz	0.5-1.0 oz + 21-32 oz	0.75-1.0 oz + 32-40 oz	Research has shown adequate activity of Aim without NIS or COC when tank mixed with boll opening rates of ethephon
ET + Ethephon	1.5 oz + 21-32 oz	1.5 oz + 21-32 oz	1.5 oz + 32-40 oz	Limited information is available regarding ET tank mixes. Addition of COC may be necessary for maximum activity.
Harvade + Ethephon	8 oz +21-32 oz +1pt. COC	8 oz +21-32 oz +1 pt. COC	8 oz + 32-40 oz +1pt. COC	Harvade requires COC for best results
Dropp SC + Ethephon	1.6-2.4 oz + 21-32 oz Ethephon	1.6-3.2 oz + 21-32 oz Ethephon	Do Not Use	Activity of Dropp/Freefall is slow and may require additional surfactant for best results. Increased rates with high rates of ethephon may cause desiccation in warm temperatures.
Finish 6 Pro + Def/Folex	21-24 oz + 4-6 oz	24-32 oz + 4-6 oz	32-40 oz + 6-8 oz	Addition of Def/Folex to Finish 6 Pro increases defoliation activity. High rates of Def/Folex may not be needed in warm temperatures
Finish 6 Pro + Aim	21-24 oz + 0.5 oz	24-32 oz 0.5-0.75 oz	32-40 oz + 0.5-0.75 oz	Addition of Aim to Finish 6 Pro increases defoliation activity and weed desiccation.
Finish 6 Pro + ET	21-24 oz + 1.5 oz	24-32 oz + 1.5 oz	32-40 oz + 1.5 oz	Addition of ET to Finish 6 Pro increases defoliation activity and weed desiccation.
Finish 6 Pro + Ginstar	21-24 oz + 2-4 oz	24-32 oz + 2-4 oz	32-40 oz + 4-6 oz	Addition of Ginstar to Finish 6 Pro increases defoliation and activity on juvenile growth. High rates of Ginstar may not be needed in warm temperatures
FirstPick + Def/Folex	56-64 oz + 4-6 oz	64-84 oz + 4-6 oz	84-96 oz + 6-8 oz	Addition of Def/Folex to FirstPick Pro increases defoliation activity. High rates of Def/Folex may not be needed in warm temperatures
FirstPick + Aim	56-64 oz + 0.5 oz	64-84 oz + 0.5-0.75 oz	84-96 oz + 0.5-0.75 oz	Addition of Aim to FirstPick increases defoliation activity and weed desiccation.
FirstPick + ET	56-64 oz + 1.5 oz	64-84 oz + 1.5 oz	84-96 oz + 1.5 oz	Addition of ET to FirstPick increases defoliation activity and weed desiccation.
FirstPick + Ginstar	56-64 oz + 2-4 oz	64-84 oz + 2-4 oz	84-96 oz + 4-6 oz	Addition of Ginstar to FirstPick increases defoliation and activity on juvenile growth.
FirstPick	56-64 oz	64-96 oz	64-96 oz	FirstPick is a good stand alone product in well cutout situations but addition of a herbicidal defoliant may increase activity in more difficult situations

Table 6. Treatment combinations for defoliation, boll opening and re-growth control.

Treatment	Early season: Highs in 90s, Lows in 70s	Mid season: Highs in 70s, Lows in 50s	Late season: Highs in 60s, Lows in 40s	Remarks
		Product per acre		
Def/Folex + Dropp SC +Ethephon	6-8 oz + 1.6-2.4 oz + 21-32 oz	8-12 oz + 1.6-3.2 oz + 24-32 oz	12-24 oz + 1.6-3.2 oz + 32-40 oz	Excessive rates of any of the three tank mix partners can lead to increased desiccation in warmer temperatures. For maximum re-growth control, at least 2.4 oz Dropp must be used.
Aim + Dropp SC + Ethephon + NIS	0.5-0.75 oz + 1.6-2.4 oz + 21-32 oz + 0.25% NIS	0.5-1.0 oz + 1.6-3.2 oz + 24-32 oz + 0.25% NIS	1.0-1.6 oz + 1.6-3.2 oz + 32-40 oz + 0.5% COC	Higher rates of Aim may lead to desiccation; the herbicidal nature of Aim may lead to decreased activity of Dropp/Freefall
ET + Dropp SC+Ethephon	1.5 oz + 1.6-2.4 oz + 21-32 oz +0.5 %v/v COC	1.5-2.0 oz + 1.6-3.2 oz + 24-32 oz + 0.5% COC	2.0 oz + 1.6-3.2 oz + 32-40 oz + 0.5% COC	Higher rates of ET may lead to desiccation; the herbicidal nature of ET may lead to decreased activity of Dropp/Freefall
Harvade + Dropp SC + Ethephon	8 oz + 1.6-2.4 oz + 21-32 oz + 1 pt. COC	8 oz + 1.6-3.2 oz + 24-32 oz + 1 pt. COC	8 oz + 1.6-3.2 oz + 32-40 oz + 1 pt. COC	For maximum re-growth control, use a minimum of 2.4 oz Dropp SC or 0.15# Freefall 50WP
Dropp SC + Ethephon	1.6-2.4 oz + 16-24 oz	1.6-3.2 oz + 24-32 oz	Do Not Use	Excellent defoliation of juvenile growth; at least 2.4 oz Dropp needed for maximum re-growth control
Ginstar + Ethephon	6.4 oz + 21-24 oz	6.4-8.0 + 24-32 oz	6.4-10 oz + 32-40 oz	For maximum re-growth control, a minimum of 6.4 oz Ginstar is needed; higher rates of Ginstar may not be needed for re-growth control when temperatures are cool and not conducive to re-growth
Finish 6 Pro + Ginstar	21-24 oz + 2-4 oz	24-32 oz + 2-4 oz	32-40 oz + 4-6 oz	For maximum re-growth control, a minimum of 6.4 oz Ginstar is needed; higher rates of Ginstar may not be needed for re-growth control when temperatures are cool and not conducive to re-growth
Finish 6 Pro + Dropp SC	21-24 oz + 1.6-2.4 oz	24-32 oz + 1.6-2.4 oz	32-40 oz + 1.6-2.4 oz	Higher rates of Dropp SC may not be needed for re-growth control when temperatures are cool and not conducive to re-growth
FirstPick + Ginstar	56-64 oz + 2-4 oz	64-84 oz + 2-4 oz	64-96 oz + 4-6 oz	For maximum re-growth control, a minimum of 6.4 oz Ginstar is needed; higher rates of Ginstar may not be needed for re-growth control when temperatures are cool and not conducive to re-growth
FirstPick + Dropp SC	56-64 oz + 1.6-2.4 oz	64-84 oz + 1.6-2.4 oz	64-96 oz + 1.6-2.4 oz	Higher rates of Dropp SC may not be needed for re-growth control when temperatures are cool and not conducive to re-growth

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