As the name implies, these chemicals prepare the cotton crop for harvest by reducing foliage and plant moisture that would otherwise interfere with harvesting operations. Harvest-aid chemicals are generally classified as either defoliants or desiccants.

The true defoliants are chemicals that cause abscission or shedding of leaves earlier than normal, but do not necessarily kill the entire plant. Defoliation is usually a milder treatment than desiccation, although further plant development, including boll maturation, stops after the chemical is applied.

Desiccants are chemicals that kill the plant tissue and cause a rapid loss of water from the foliage. The plants usually are killed so rapidly that defoliation cannot take place and the leaves remain attached to the plants. Desiccation of the entire plant is necessary in areas where cotton is stripper-harvested. In some instances, low application rates of desiccants may result only in defoliation, while high rates of defoliants, together with high temperature, can cause plant desiccation.

Although many factors are involved in getting good results from a defoliant or desiccant, plant and weather conditions during and following application are of major importance. Good results from harvest-aid chemicals usually are obtained when applications are made under the following conditions:

1. Warm, calm, sunny weather.
2. Soil moisture relatively low but sufficient to maintain plant in active growth condition without moisture stress.
3. Soil nitrogen levels near depletion.
4. Leaves active and uniformly expanded on the plants.
5. Little or no secondary growth evident on the plants.
6. Plants have stopped primary vegetative growth, are shedding some mature leaves and have a high percentage of open bolls.

Poor results with harvest-aid chemicals can frequently be attributed to the following conditions:

1. Applications made under cool (below 60°), cloudy conditions.
2. Prolonged periods of wet weather following treatment.
3. Plants are severely moisture stressed and have tough, leathery leaves at the time of treatment.
4. High soil moisture and nitrogen levels which contribute to rank, dense foliage and late maturity.
5. Plants with considerable secondary growth after a "cut out" period.
6. Improper calibration of application rates and poor spray coverage.

TIMING OF APPLICATION

The percentage of open bolls is the best guide in determining when to apply harvest-aid chemicals. A defoliant may be applied when 60 percent or more of the bolls are open. Application of desiccants should be delayed until 75 percent or more of the bolls are open. Irrigated cotton should have at least 80 percent open bolls before desiccating. Mature, unopen bolls are firm, cannot be dented by pressure exerted between the thumb and forefinger and cannot be cut easily with a sharp knife. At this stage, fiber and seed development is essentially complete, and only minimal reduction in lint yield will be caused by chemical treatment. On the other hand, too early application of either a defoliant or desiccant can have the following adverse effect:

1. Reduced lint yield
2. Reduced micronaire value
3. Lower seed grade
4. Lower seed quality for planting purpose
5. Reduced fiber strength

The maturity of cotton cannot be hastened through the use of harvest-aid chemicals. Only time and favorable weather will mature cotton. However, harvest-aid chemicals will promote more rapid opening of mature bolls and prepare the crop for earlier harvesting.
MANAGING HARVEST-AID PROGRAM

In extremely rank cotton, bottom defoliation may be helpful in reducing boll rot and harvesting losses. Usually such treatments are applied when only $\frac{1}{3}$ to $\frac{1}{2}$ of the bolls are fully mature. Consequently, producers should use extreme caution to avoid complete defoliation of the plant. For bottom defoliation use half the minimum rate given on the label for defoliants.

Treat only sufficient acreage to stay ahead of harvesting operations. If a second application is required, use a chemical with a different active ingredient to stay within the safe residue tolerance. When cotton has reached desired maturity, the operator should check weather forecasts to avoid as much unfavorable weather as possible during the application period. After applying a desiccant, a 1- or 2-week "curing out" period is required prior to stripper harvest. Regrowth and barky cotton can result from either stripping too early after applying a desiccant or delaying the stripping too long after desiccation. Seed cotton and all plant parts should be dry before stripping. Cotton is dry when it fluffs well, and plant parts are dry when they are crisp or brittle.

SECONDARY GROWTH

Development of secondary growth is a frequent problem following harvest-aid treatments. Conditions that favor foliage regrowth are late season periods of warm, wet weather on a crop with a high percentage of open bolls. Plants with unopen bolls or young, developing bolls are less likely to produce secondary growth, yet application made at this stage would result in reduced lint quality and yield.

Secondary growth is difficult to control since the young foliage does not form abscission layers or shed like older leaves. The producer should be aware that several cotton varieties do not form adequate abscission layers and will not defoliate properly. Desiccants such as arsenic acid, which completely kill plant tissue, are fairly effective and could be used under these conditions. Combinations of some compounds such as paraquat with chlorate or phosphate-type defoliants are also being used to improve control of secondary growth. Be sure to read the label carefully before mixing different formulations of harvest-aid chemicals.
To reduce gin trash, harvesting is often scheduled after desiccation during a period when secondary growth is limp, but not yet brittle. Note: Harvesting must be delayed for the time period indicated on the chemical label.

**INSECT CONTROL**

Harvest-aid chemicals play an important role in early stalk destruction for reducing boll weevil, pink bollworm, bollworm and tobacco budworm populations. Some insecticides can be added to certain harvest-aid chemicals to reduce overwintering boll weevil populations. For example, Guthion can be mixed with arsenic acid and phosphate-type defoliants. However, no organic compounds, including insecticides, should be added to chlorate-type defoliants unless the label specifically states that such mixtures are permissible. Once these mixtures become dry, they can be a potential fire hazard. Combinations of phosphate-type defoliants (Folex and DEF) and phosphate insecticides should be used with caution since greater toxicity may be encountered from the mixture than from either of the compounds used alone. See L-508 and L-561, guides for controlling cotton insects (Texas Agricultural Extension Service), for additional information regarding the use of insecticides in combination with harvest-aid chemicals.

**CARE OF EQUIPMENT**

Prepare application equipment by thoroughly cleaning spray tanks, pumps, lines and nozzles to remove residue left from prior pesticide usage. Check for nozzle wear by measuring output and shape of spray pattern. Once in the field, flush the sprayer system with clean water after each day's operation.

If phosphorous-type insecticides have been used in the same spray equipment, thoroughly wash the spray tank and remove any dried deposits, especially if they occur on fabric of aerial application equipment. Likewise, if chlorate-type chemicals have been used in the same spray equipment, thoroughly clean equipment before applying phosphate-type defoliants.
SAFETY WITH CHEMICALS

Avoid application on windy days to reduce the hazard of spray drift to desirable crops. Lowering spray pressure and correcting nozzle size and spray angle also help reduce drift. Protect the operator from spray drift. If chemicals come in contact with skin, wash immediately with soap and water. Store chemicals in a safe place out of reach of small children. Keep chemicals in their original, properly labeled containers, away from human food, animal feed, fertilizer, seed insecticides and fungicides. The storage area should be away from any fire hazard.

Rinse empty arsenic acid containers with water before burning or burying. When filling spray tanks, avoid back-siphoning by keeping the water delivery hose out of the arsenic acid and other harvest-aid chemicals. Never flush spray equipment into ditches or streams that could contaminate the water supply.

All harvest-aid chemicals used have a tolerance or an exemption from tolerance designated for their safe use. Until official federal regulations are issued governing the use of a specific harvest-aid chemical, it should not be used.

It is the responsibility of the manufacturer or formulator of a particular harvest-aid chemical to obtain registration with the Environmental Protection Agency.
## Guide for Use of Defoliants and Desiccants

<table>
<thead>
<tr>
<th>Chemical name</th>
<th>Trade name</th>
<th>Percent active ingredient(s)</th>
<th>Maximum registered rates (lb. a.e. per acre)</th>
<th>Residue allowable (PPm)</th>
<th>Ground machine</th>
<th>Airplane</th>
<th>Comments and Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Chlorate</td>
<td>Oxy Leafex-3 Cotton Defoliant</td>
<td>28.0</td>
<td>1-1/2 gal.</td>
<td>5.0</td>
<td>Exempt</td>
<td>10-20</td>
<td>5-10</td>
</tr>
<tr>
<td>Drop Leaf Defoliant</td>
<td>28.0</td>
<td>1-1/2 gal.</td>
<td>5.0</td>
<td>Exempt</td>
<td>10-20</td>
<td>5-10</td>
<td></td>
</tr>
<tr>
<td>Tide Chlorate</td>
<td>27.2</td>
<td>1-1/2 gal.</td>
<td>5.0</td>
<td>Exempt</td>
<td>20-30</td>
<td>4-7</td>
<td></td>
</tr>
<tr>
<td>Riverside Chlorates</td>
<td>29.5</td>
<td>1-1/2 gal.</td>
<td>5.0</td>
<td>Exempt</td>
<td>10-20</td>
<td>5-10</td>
<td></td>
</tr>
<tr>
<td>FMC Corporation Leaf Dropper Defoliant</td>
<td>18.2</td>
<td>1-1/2 gal.</td>
<td>5.0</td>
<td>Exempt</td>
<td>20-30</td>
<td>4-7</td>
<td></td>
</tr>
<tr>
<td>Super Leaf Dropper Defoliant</td>
<td>28.0</td>
<td>1-1/2 gal.</td>
<td>5.0</td>
<td>Exempt</td>
<td>20-30</td>
<td>7-10</td>
<td></td>
</tr>
<tr>
<td>Sodium Cacodylate</td>
<td>Cacodylic Acid</td>
<td>28.4</td>
<td>2-3 pts.</td>
<td>1.3</td>
<td>of Cacodylic Acid</td>
<td>28.8 as on Cacodylic Acid</td>
<td>15-25</td>
</tr>
<tr>
<td>Sodium Chlorate</td>
<td>Cacodylic Acid</td>
<td>28.4</td>
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<td>1.3</td>
<td>of Cacodylic Acid</td>
<td>28.8 as on Cacodylic Acid</td>
<td>15-25</td>
</tr>
<tr>
<td>S, S, S - Tributyl</td>
<td>DEF -6</td>
<td>70.5</td>
<td>1 1/2 - 2 pts.</td>
<td>1.5</td>
<td>4.0 on cotton seed</td>
<td>2.0 on cottonseed hulls</td>
<td>10-20</td>
</tr>
<tr>
<td>Phosphorotrithioate</td>
<td>72</td>
<td>1 1/2 - 2 pts.</td>
<td>1.5</td>
<td>0.25 on cotton seed</td>
<td>10-20</td>
<td>5-10</td>
<td></td>
</tr>
<tr>
<td>Tributyl Phosphorotrithioate</td>
<td>72</td>
<td>1 1/2 - 2 pts.</td>
<td>1.5</td>
<td>0.25 on cotton seed</td>
<td>10-20</td>
<td>5-10</td>
<td></td>
</tr>
<tr>
<td>Endothall</td>
<td>Accelerate</td>
<td>15.9</td>
<td>1-1/2 pts.</td>
<td>0.13</td>
<td>0.1 on cottonseed</td>
<td>15-25</td>
<td>5-12</td>
</tr>
<tr>
<td>DESICCANTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic Acid</td>
<td>L-10 Desiccat</td>
<td>75.0</td>
<td>1-1/2 qts.</td>
<td>4.4</td>
<td>4 as As O₃ on cottonseed</td>
<td>10-15</td>
<td>5-10</td>
</tr>
<tr>
<td></td>
<td>Hi-Yield H-10</td>
<td>75.0</td>
<td>1-1/2 qts.</td>
<td>4.4</td>
<td>4 as As O₃ on cottonseed</td>
<td>10-15</td>
<td>5-10</td>
</tr>
<tr>
<td>Paraquat</td>
<td>Ortho Paraquat C1</td>
<td>29.1</td>
<td>1-2 pts.</td>
<td>0.5</td>
<td>0.5 on cottonseed</td>
<td>10-30</td>
<td>3-10</td>
</tr>
</tbody>
</table>

**Additives**

| Endothall | Accelerate | 15.9 | 1-1/2 pts. | 0.13 | 0.1 on cottonseed | 15-25 | 5-12 |

This rate will not give satisfactory defoliation if used alone. Improves the activity of other herbicide chemicals. May be used with sodium chloride (with suitable fire suppressant) or organic phosphate cotton defoliants. Avoid contact with or drift to other crops, trees or plants. Wash out sprayer immediately. Do not contaminate water.

**Consult chemical label for further comments and limitations.**

*For further information, consult leaflets L-558, L-218, L-561, L-1219, guides for controlling cotton insects.

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