

Defoliants, Desiccants, and Growth Regulators Used on New Mexico Cotton

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What's in this guide...

Introduction	1
Defoliants	
What are they?	1
Recommended defoliants and application guidelines (table 1)	2
Advantages and disadvantages	1
Other considerations	1
Desiccants	
What are they?	2
Recommended desiccants and application guidelines (table 2)	3
Advantages and disadvantages	2
Other considerations	3
Growth regulators	
What are they?	3
Plant growth regulators defined (table 3)	4
Recommended growth regulators and application guidelines (table 4)	4
Advantages and disadvantages	3
Other considerations	3
Recent research	5
Safe use and New Mexico law	5
References	5

Defoliants, desiccants, and growth regulators are chemicals used in agricultural production to accelerate the preparation of crops for mechanical harvest. In 1995 at least 162 of these chemicals were labeled for agronomic crops in the United States, however, in New Mexico defoliants are used commonly only on cotton.

Virtually all the cotton crop in New Mexico is mechanically harvested using spindle and stripper harvesters. Defoliants and desiccants are used to reduce and remove foliage from cotton prior to harvest (although many producers depend on frost for defoliation). Growth regulators are primarily used to open bolls and to alter the vegetative and reproductive development of cotton. Producers also have used these

chemicals to increase harvest efficiency, reduce lodging, reduce trash and lint staining, reduce cotton seed moisture, and decrease insect populations.

Thus, defoliants, desiccants, and growth regulators can have an important role in preparing cotton grown in New Mexico for harvest.

DEFOLIANTS

Defoliants are chemicals or methods of treatment that cause only the leaves of a plant to *abscise*, or fall off. Defoliants are applied to cotton to improve and facilitate mechanical harvest. Currently, between 25 and 50% of the cotton grown in New Mexico is chemically defoliated each year. Sodium chlorates such as Helena 6#, Drexel, Defol, and Tide Chlorate were among the first chemicals used as defoliants, and they still are used extensively in cotton production in the Pecos and Mesilla valleys. Other highly effective defoliants include Def-6 and Folex (both organophosphorus compounds), as well as Harvest 5-F, Ginstar, and Quick Pick.

Current information on defoliant selection, application, and proper use is provided in table 1.

Advantages and Disadvantages

Defoliants can increase picker efficiency by reducing foliage as well as decrease seed moisture, boll rotting, and pink bollworm and bollweevil populations. However, improper use of defoliants can cause yield loss and reduced fiber quality, including low micronaire and fiber stain from regrowth. Multiple applications may be necessary. Also, defoliants increase production costs.

Other Considerations

The major limitation of using chemical defoliants has been their inconsistent response in the field. The

Table 1. Suggestions for defoliant in New Mexico.

Common name	Trade name	Suggested rate/acre	Dilution (ground application)	Water/acre (g) (aerial application)	Comments
Sodium chlorates (with fire suppressant)	Helena 6# (sodium chlorate)	2-3 qt	15-30	4-10	Apply 7 days prior to harvest. Do not add insecticides or other chemicals unless specified on label. Do not graze treated areas or feed gin trash to livestock.
	Drexel Defol	1-1.5 gal	15-20	5	
	Drexel Defol-6	2-3 pt	15-20	5	
	Tide Chlorate	1-1.5 gal	20-30	4-7	
	Riverside Chlorate	1-1.5 gal	10-20	5-10	
Sodium cacodylate	Quick Pick	2-3 pt	5-10	15-25	Add 1/3-2/3 pt of non-ionic surfactant. Apply 7-10 days prior to harvest.
S, SS (Tributyo)	Def-6	1.5-2 pt	10-20	5-12	Requires 5-7 days minimum for leaf drop (10-14 days may be required). Apply specified rates to give thorough coverage.
Tributyl Phosphorotrihiolite	Folex	1.5-2 pt	10-20	5-12	Higher rates may be necessary. Certain phosphate insecticides can be mixed with Def or Folex for late-season boll weevil control.
Dimethipin	Harvard 5-F	6-8 fl oz + crop oil concentrate	10-20	5+	Use 8 fl oz/acre plus crop oil concentrate for first application; use 6 oz plus oil applied 5-7 days later. Avoid spray drift.
Thidiazuraon	Ginstar	0.4-1	10-25	2-10	Apply when top harvestable boll is mature. Apply at least 5 days prior to harvest. (It may be necessary to apply a standard desiccant or application of Ginstar.)

Adapted from Oklahoma State University, 1995.

effectiveness of a defoliant depends on timing and rate of application; environmental conditions; absorption, degradation, and translocation; plant uniformity and affective coverage; and use of surfactant and tank mixes. Refer to table 1 for application guidelines.

DESICCANTS

Desiccants are chemicals (essentially contact herbicides) that rapidly kill the leaves, but leave them attached to the plants. Desiccants such as sodium chlorates and Quick Pick cause rapid water loss from the leaves; they are often used to kill regrowth. They are used primarily when cotton is harvested with strippers. Paraquat formulations are the most widely used desiccants in New Mexico, although endothall (Accel-

erate) is also used in a tank mix with paraquat. High rates of defoliant (such as sodium chlorate formulations and Def-6) applied at high temperatures also provide effective desiccation.

The labeled desiccants for New Mexico, their application rates, and proper uses are given in table 2.

Advantages and Disadvantages

The advantages of using desiccants include the ability to schedule harvests, increased stripper harvester efficiency, decreased seed moisture, and control of late-season weeds. Some disadvantages are reduced quality and yield when applied improperly; delayed harvest that can result in stalk deterioration; and increased production costs. Refer to table 2 for application guidelines.

Table 2. Suggestions for desiccants in New Mexico.

Common name	Trade name	Suggested rate/acre	Dilution (ground application)	Water/acre (g) (aerial application)	Comments
Paraquat	Gramoxone Extra [†]	3–24 oz	Min. 10	Min. 10	Apply when >80% bolls are mature. Use a nonionic surfactant at 8–32 fl oz/100 gal mix. Most effective in western areas of the state. Apply 7–10 days before harvest. Do not pasture livestock in treated fields within 15 days after spraying. Livestock should be removed from treated areas 30 days before slaughter. Warning: Paraquat is extremely hazardous when ingested. Avoid spray drift.
	Cyclone [†]	4 oz–2 pt	10–30	3–10	
Endothall and Paraquat	Accelerate and Paraquat [†]	1–2 pt 0.5–2 pt	10–30	3–10	Apply 3+ days before harvest. Use nonionic surfactant at 1 pt/gal mix. Recommended for stripper harvested cotton. Use high rates with green and/or considerable growth.

[†] Restricted-use pesticide.

Adapted from Oklahoma State University, 1995.

Other Considerations

The major limitation of using desiccants has been improper timing of application. For example, a desiccant applied when 80% of the bolls are open (that is, too early) can cause significant yield reductions. Desiccants should be applied when more than 80% of the bolls are open. A paraquat and sodium chlorate mix has been found to increase desiccation.

GROWTH REGULATORS

Growth regulators are natural or synthetic plant hormones (*phytohormones*) that influence growth responses such as germination, abscission, dormancy, and stomatal closure, as well as inhibit growth and other plant responses (table 3).

The growth regulators commonly used in cotton in New Mexico are Pix and Prep. Pix is commonly used to increase boll retention, reduce vegetative growth, and stimulate earlier maturity. Prep, the only synthetic ripening chemical used in the U.S., is used primarily as a boll-opening chemical. However, Prep also may provide effective defoliation when favorable environmental conditions exist, and it has been shown effec-

tive in managing pink bollworm. The labeled plant growth regulators for New Mexico, their application rates, and proper uses are given in table 4.

Advantages and Disadvantages

The advantages of using growth regulators include earlier harvest dates, reduced vegetative growth, increased once-over harvesting, improved defoliation and less trash, and reduced pink bollworm populations. However, growth regulators can cause erratic crop responses, reduced yields and fiber quality, and increased production costs when applied at improper rates and timing. Refer to table 4 for application guidelines.

Other Considerations

The major limitation of plant growth regulators has been their inconsistent response in the field. Generally this is related to application rates and timing, as well as environmental conditions at the time of application.

Pix and Prep applications generally are not recommended as standard management practices. Both can be effective under certain circumstances, although they may or may not result in increased yields. Cotton

Table 3. Plant growth regulators.

- Absciscic acid** A natural plant hormone involved in abscission, dormancy, stomatal closure, growth inhibition, and other plant responses.
- Auxins** A class of plant growth regulators chemically and functionally related to the natural hormone indoleacetic acid (IAA) that controls growth, development, and metabolism at low concentrations.
- Cytokinins** A group of plant growth hormones important in regulating nucleic acid and protein metabolism and in cell division, organ initiation, and delaying senescence.
- Ethylene** A gaseous growth hormone (C₂H₄) that regulates various aspects of vegetative growth, fruit ripening, abscission of plant parts, and the senescence of flowers.
- Gibberellins** Stimulate new growth and influence shoot formation in plant tissue culture material. Includes gibberellic acid.

Table 4. Suggestions for growth regulators in New Mexico

Common name	Trade name	Suggested rate/acre	Dilution (ground application)	Water/acre (g) (aerial application)	Comments
Mepiquat	Pix	0.13–0.5 pt	>10	>3	Apply when plants are in the early bloom stage (0.5 pt/acre rate has been most effective) and about 24" tall. Plant heights can range from 20–28" as long as the cotton is less than 8 days past early bloom. Up to 4 days past early bloom, low-rate applications are optional, allowing discontinuing the applications (beginning at pinhead square) if stresses occur. Pix should not be applied if plants are under severe stress (from weather; mite, insect or nematode damage; diseases and/or herbicide injury). If drought stress occurs when Pix is applied, or after a full rate (0.5–1 pt) has been applied, results will be less than optimal.
Ethephon	Prep (6 lb AI/gal)	For boll opening 1.3–2.8 pt For pre-conditioning g .7–1.4 pt	15–50 gal 15–50 gal 15–50 gal	2–5 2–5 2–5	Apply when 50–60% or more bolls are open (that is, when the top harvestable boll is mature). To prepare crop for defoliation, treat with Prep 4–14(+) days before defoliation treatment. Prep can be mixed with Def, Folex, Ginstar, Harvade, methyl parathion, guthion and malathion. Prep and Ginstar has been an effective tank mix in some cases. Some premature drop of immature bolls may be associated with application. Do not apply Prep if rain is expected in the next 8 hours. Temperatures 65°F or lower after treatment will delay boll opening.

[†] Restricted-use pesticide
Adapted from Oklahoma State University, 1995.

producers should evaluate their objectives before deciding to use these chemicals.

RECENT RESEARCH

Researchers studying defoliation in Pima and Upland cotton are evaluating the effectiveness of defoliants such as sodium chlorate, Ginstar, Starfire, Dropp, Def, and their combinations. Generally, no significant differences in yield have been found between the untreated checks and defoliation treatments. These results show that the effectiveness of defoliant applications varies between years, locations, and even within fields.

Based on more than 20 years of studies on growth regulators in Pima and Upland cotton, researchers are trying to determine optimal application guidelines for existing products as well as new products such as PGR IV, Glyphosate, and Atomik. Although additional research is needed, current and new growth regulators can be useful for controlling growth. However, results have yet to show consistent and significant increases in cotton yields.

SAFE USE AND NEW MEXICO LAW

The suggested uses of defoliants, desiccants, and growth regulators in New Mexico are based on the manufacturer's label. Application rates and the intervals from application to harvest are based on tolerances established by the Environmental Protection Agency for these chemical residues. The use of trade names does not indicate an endorsement of or discrimination against other products by the NMSU Cooperative Extension Service. We do not claim that this list is complete. Please use all agricultural chemicals safely, and read and follow all label directions. Wear protective clothing when mixing and applying defoliants, desiccants, and growth regulators.

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