

8. SUGGESTIONS FOR GROWTH REGULATOR USE

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Growth regulators are used to control cotton plant height. Mepiquat chloride, the active ingredient in Mepiquat, is now available under other trade names. Mepiquat pentaborate is the active ingredient in a new growth regulator named Pentia. These growth regulators are both anti-gibberellens that control plant height and can increase earliness. Several non-mepiquat growth regulators are sold for use in cotton, but there are no data to support the use of any growth regulators that do not contain some form of mepiquat in North Carolina. Because the activity of Mepiquat chloride and Mepiquat pentaborate are similar, I will refer to them as mepiquat in this chapter.

Mepiquat can be applied as a broadcast spray or as a banded spray. Research at North Carolina State University has shown that Mepiquat also can be applied through a canvas wick applicator. The greatest advantage the wick seems to have over spray applications is that it makes it easier to apply Mepiquat to tall cotton and avoid application to shorter, stressed cotton within the same field. More detailed information about using a wick can be found on the Internet in Carolina Cotton Notes at <http://www.cropsci.ncsu.edu/ccn/2000/2000.htm>. Information on calibrating a wick applicator can be found at the same site.

Plant Modification

Mepiquat can help cotton growers manage the development and maturity of their crop. Research conducted in North Carolina, as well as in other areas of the cotton belt, has demonstrated that Mepiquat treatment can hasten maturity, reduce plant height, facilitate insect management, decrease boll rot, and increase yield.

These desirable features are caused by the inhibition of cell elongation in the cotton stems. Mepiquat-treated plants are normally smaller and more compact. Internodes along the stem and fruiting branches are shortened. The total number of fruiting branches also may be reduced slightly. Energy is directed toward boll production and away from vegetative growth.

Normally, our North Carolina season does not give us enough time to mature the bolls produced on the highest fruiting branches. In Mepiquat-treated cotton, those positions are not formed. In untreated cotton, those additional fruiting positions frequently are not harvested.

Season Considerations

In rain-fed cotton production, the presence or absence of timely rainfall largely determines the length of the growing season and the plant's ability to produce and mature bolls.

If we experience timely rainfall, cotton normally produces excellent yields, with or without Mepiquat. When excessive rainfall occurs, particularly when soil nitrogen is plentiful, Mepiquat treatment is usually an excellent investment.

However, what happens when drought or another stress occurs that limits square production? If the stress occurs three weeks into bloom and continues for the remainder of the bloom period, then Mepiquat-treated cotton frequently will out-yield untreated cotton because the Mepiquat-treated cotton sets a greater portion of the crop earlier. If, however, the stress occurs during or immediately following the application of 1 pint per acre of Mepiquat (a normal application amount), the situation may be quite different.

If drought continues for the remainder of the season, nothing will help. If the drought breaks after one to two weeks, the Mepiquat-treated cotton may have a difficult time resuming growth and boll loading because Mepiquat tends to reduce vegetative growth and the associated square production.

Treatment with the plant growth regulator does not guarantee the results mentioned above, particularly increased yield. Yields of Mepiquat-treated cotton may be reduced when biological and environmental conditions do not favor excessive vegetative (rank) growth. However, a single application of Mepiquat with a rate appropriate for plant size rarely decreases yield. As with any management tool, the decision to use Mepiquat should be based on a consideration of its usefulness in a specific situation. Your decision to apply Mepiquat in any given year should be made on a field-by-field (or portion-of-a-field) basis. Certain cotton fields may require treatment every year, whereas others will rarely require treatment.

Conditions Favoring Mepiquat Use

Mepiquat use is usually warranted when conditions favor rank growth and delayed maturity. Some of these conditions are:

- Cotton planted after May 15.
- Thick stands (more than 4 plants per foot of row).
- High nitrogen rates.
- Excessive rainfall within 7 days of treatment.
- Fields with a history of rank cotton growth.
- Large, indeterminate varieties.
- Fields with delayed maturity.
- Fields that will be defoliated and harvested first.

The more of these conditions that are present, the greater the likelihood of a positive response to Mepiquat treatment. Conversely, if the above conditions are not present, Mepiquat treatment may not be worthwhile.

Application Strategies

Several Mepiquat application strategies have been developed. Three—early bloom, low-rate multiple, and modified early bloom—are discussed below with guidelines for each. The low-rate multiple approach is not recommended in North Carolina due to poor early season growth. One exception might be a vigorous and late-maturing variety, such as Deltapine 555, when early weather conditions favor rapid growth.

I. Early Bloom Strategy

The most commonly used technique is the application of ½ to 1 pint of Mepiquat at early bloom (defined as 5 to 6 white blooms per 25 feet of row) on cotton that is more than 24 inches tall if conditions favor a response to Mepiquat. Cotton that is less than 20 inches tall at early bloom does not receive a treatment. The ½- to 1-pint rate is also applied if the cotton averages 28 inches tall, even if early bloom has not yet occurred.

Applications may be made after early bloom if cotton growth becomes excessive (following early bloom). Treatment rates range between ½ and 1 pint per acre. **Note:** Treatments applied later than 7 days after early bloom will have less impact on earliness and less potential to increase yield.

Mepiquat use decisions should be based on the development of the crop, environmental conditions, and time of the season. The following guidelines will assist in making situation-specific decisions for Mepiquat use. Remember that Mepiquat should not be applied to drought-stressed cotton. Wait until stress is relieved before application. Consult the label for additional precautions.

Situation 1

Plant height less than 20 inches at early bloom because of stress.

Response

Relieve stress if possible. Avoid Mepiquat application right away. Treatment may be required later, but wait and see.

Situation 2

Plant height 20 to 24 inches tall at early bloom.

Response

If bloom begins before July 10, then crop is on schedule. Wait and see. Mepiquat at 1 pint per acre may be required later, particularly if plant height exceeds 28 inches within one week of early bloom.

If bloom begins after July 10, particularly after July 20, then apply ½ pint of Mepiquat per acre to compact the boll-loading period if the crop is not under drought stress.

Situation 3

Plant height more than 24 inches at early bloom; plant growing rapidly.

Response

Apply ½ pint of Mepiquat per acre to reduce shading and improve boll set. An additional ½ to 1 pint of Mepiquat per acre (depending on previous treatment rate) may be required if plant height exceeds 28 inches one week after early bloom or 32 inches two weeks after early bloom.

Situation 4

Plant height approaching 20 to 24 inches before early bloom. Growth rapid; condition well-watered. Anticipated early bloom height more than 24 inches.

Response

If prebloom cotton is 16 inches tall, apply ¼ pint per acre. If prebloom height is 20 inches or more before first treatment, apply ½ pint per acre. An additional Mepiquat treatment may be necessary if plant height exceeds 24 inches at early bloom, 28 inches one week after early bloom or 32 inches two weeks after early bloom.

II. Low-Rate Multiple Application Strategy

Recently, an alternate strategy has been developed to reduce the risks associated with an early bloom Mepiquat treatment that precedes a drought period. This strategy employs the use of low-rate multiple applications (LRMA) of Mepiquat beginning at match-head square (50 percent of plants with one or more squares 1/8 to 1/4 inch in diameter). The first treatment of 1/8 to 1/4 pint occurs at match-head square if conditions favor a response to Mepiquat. Further treatments are made at 7- to 14-day intervals when conditions favor a response to Mepiquat.

This approach is logical and should enable you to achieve the benefits of Mepiquat, particularly if you have irrigation capabilities, while reducing the risks associated with the product (early cutout). Instead of running the risk that drought stress may occur immediately after a larger, early bloom treatment, you should be able to mete out smaller doses that enable you to fine-tune the crop's development. However, research in North Carolina has shown this strategy to be the one most likely to reduce yields, as compared to the early bloom or modified early bloom strategies.

Remember that pinhead square occurs when a cotton plant's first flower bud is just visible to the naked eye. Match-head square (squares 1/8 to 1/4 inch in diameter) occurs about 7 days later. First bloom occurs about 21 days after pinhead square and 14 days after match-head square. Early bloom (5 to 6 white blooms per 25 feet of row) occurs within 5 to 7 days of first bloom.

Table 8-1 provides a point system to help producers select rates for the LRMA approach. Because it is impossible to put all considerations into a usable chart, an experienced producer may be able to make better decisions than the chart would recommend. This point system is much better than a "shot-in-the-dark" guess that an inexperienced producer might have to make. Use the appropriate portion of the

Table 8-1. Point System for Determining Mepiquat Rates Using an LRMA Approach

FIRST SQUARE				
Points				
	-1	0	1	2
Moisture		fair	excellent	
Stalk height history	< 36 in.	36 to 44 in.	44 to 48 in.	> 48 in.
Date of first square		before June 15	after June 15	
Variety		short or medium	tall	

If score is greater than 3, do not apply.
 If soil moisture is poor, do not apply.
 Do not exceed a total of 4 ounces.

10 TO 14 DAYS AFTER FIRST SQUARE				
Points				
	-1	0	1	2
Moisture		fair	excellent	
Stalk height history	< 36 in.	36 to 44 in.	44 to 48 in.	> 48 in.
Square retention		>75%	<75%	
Prior Mepiquat applied		> 3 oz	0 to 3 oz	
Height-to-node ratio	< 1.4	1.4 to 1.7	> 1.7	

If score is less than 3, do not apply.
 If soil moisture is poor, do not apply.

EARLY BLOOM				
Points				
	-1	0	1	2
Moisture	fair	good	excellent	
Plant height	< 20 in.	20 to 24 in.	> 24 in.	> 48 in.
Fruit retention		> 75%	50 to 75%	< 50%
Prior Mepiquat applied	> 8 oz	5 to 8 oz	3 to 5 oz	none
Date of first bloom		before July 10	July 10 to 20	after July 20

If NAWB is less than 7, do not apply.
 If score is less than 3, do not apply.
 If soil moisture is poor, do not apply.

10 TO 14 DAYS AFTER EARLY BLOOM					
Points					
	-1	0	1	2	4
Moisture	fair	good	excellent		
NAWB	5 or less	5 to 6	6 to 7	7 to 8	above 8
Fruit retention		> 75%	< 75%		< 30%
Prior Mepiquat applied		> 12 oz	8 to 12 oz	0 to 8 oz	
Internode length*	< 1.5 in.	1.5 to 2 oz	> 2 in.		

If NAWB is less than 5.5, do not apply.
 If score is less than 3, do not apply.
 If soil moisture is poor, do not apply.

*The largest of the internodes below the third and fourth mainstem leaf.

table for the stage of growth. Total the points to determine Mepiquat rates. For example, using Table 8-1 at first square, if you had excellent moisture, a stalk height history of 50 inches, first square on June 20, and a short variety, you would accumulate 1, 2, 1, and 0 points. This would total 4 points. The total number of points equals the number of ounces of Mepiquat that should be applied. In our example, the producer would apply 4 ounces.

III. Modified Early Bloom Strategy

Many producers have a difficult time treating their entire acreage in a timely manner using the early bloom strategy due to large acreage, lack of equipment, or wet weather. This often results in applications made too late to successfully control plant size and influence earliness. These producers may wish to use the modified early bloom approach on at least a portion of their acreage. This approach involves possible treatments 10 to 14 days before early bloom (10 to 14 days after first square), at early bloom, and 10 to 14 days after early bloom. The last application is seldom necessary if this approach is used successfully. Table 8-2 presents guidelines for its use.

Note in the charts that the internode length that triggers Mepiquat application is 2.5 inches on the first two potential applications. On irrigated cotton or cotton on extremely productive soils, one may want to be less conservative and use 2 or 2.25 inches as the trigger.

Table 8-2. Determining Mepiquat Rates Using a Modified Early Bloom Approach

10 TO 14 DAYS AFTER FIRST SQUARE			
	Plant Height		
	< 17 in.	17 to 20 in.	> 20 in.
Height-to-node ratio >1.85	4 oz	6 oz	8 oz
Internode >2.5 in.*	4 oz	6 oz	8 oz

If soil moisture is poor, do not apply.

*The largest of the internodes below the third and fourth mainstem leaf.

EARLY BLOOM — if Mepiquat has already been applied

	Plant Height			
	<24 in.	24 to 27 in.	27 to 30 in.	>30 in.
Plant height >24 in.	0 oz	6 oz	9 oz	12 oz
Internode >2.5 in.*	6 oz	6 oz	9 oz	12 oz

If soil moisture is poor, do not apply.

If NAWB is <7, do not apply.

*The largest of the internodes below the third and fourth mainstem leaf.

Table 8-2. continued

EARLY BLOOM — if Mepiquat has NOT been applied

	Plant Height			
	<24 in.	24 to 27 in.	27 to 30 in.	>30 in.
Plant height >24 in.	0 oz	8 oz	12 oz	16 oz
Internode >2.5 in.*	8 oz	8 oz	12 oz	16 oz

Do not apply if soil moisture is poor.

Do not apply if NAWB <7.

*The largest of the internodes below the third and fourth mainstem leaf.

10 TO 14 DAYS AFTER EARLY BLOOM

Mepiquat applied at early bloom

	>8 oz	0 to 8 oz
Internode <2.5 in.*	0 oz	0 oz
Internode 2.5 to 3.5 in.	8 oz	12 oz
Internode >3.5 in.	12 oz	16 oz

If soil moisture is poor, do not apply.

If NAWB is <5.5, do not apply.

*The largest of the internodes below the third and fourth mainstem leaf.