

Cotton Production in Tennessee

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Cotton production ranks third in terms of cash receipts from crops for Tennessee producers. Tennessee annually produces about 550,000-650,000 acres of cotton. Average lint yields range from 600 to 900 pounds of lint per acre. Cotton is produced in 23 counties statewide, with the majority grown in the western part of the state. Limited acres are grown under irrigation. Tennessee has long been a proponent of conservation and no-tillage systems, with approximately 52 percent of the cotton grown no-till and an additional 24 percent grown using some form of conservation tillage.

Field Selection and Preparation

Cotton is best adapted to soils that are fertile, moderately deep

to deep with good drainage, and high moisture-supplying capacity. Well-drained soils will tend to warm up early in the spring, allowing for early planting. Selecting fields with long rows, easy access and few obstacles allows for efficient use of equipment. In no-tillage production systems, erosion problems should be addressed by implementing practices such as waterways, contour planting and filter strips along drainage ditches. Sub-soiling is only beneficial if tillage pans exist and/or heavy traffic has occurred. However, three or four years of continuous no-till production has been found to reduce or eliminate traffic pans.

Good cotton stands may be obtained by no-tillage or conventional methods of seedbed preparation. A firm, well-prepared seedbed is important for fast seedling emergence and uniform stands. On soils with erosion problems, no-tillage production practices should be utilized. In conventional tillage areas, delay tillage until late winter or early spring to reduce the erosion potential. However, prepare seedbeds early enough so they will settle and firm up before planting. To prepare a seedbed on heavy-textured Delta soils, bed the land in the fall or winter. Use appropriate herbicides to kill weeds prior to planting cotton to promote a vigorous early crop.

Crop residues from cotton, corn, soybeans or grain sorghum may provide sufficient cover on some fields for erosion control. Where crop residues are not adequate, cover crops may be needed.

Cover crops that have been used in Tennessee include small grain (wheat and rye) and legumes (vetch, crimson clover or Austrian winter peas). Small grains, especially wheat, are usually preferred for no-till cotton. Small grains have a fibrous root system and will do a better job of binding the soil particles together than clovers, thereby reducing soil erosion. Rye tends to grow tall and produce more ground cover potentially shading out early season weeds. Excessive growth can interfere with planting, cause slow cotton emergence, and could also produce tall, thin cotton plants. Legumes can be more difficult to manage. They are usually more difficult to kill and the nitrogen produced may cause the cotton to be difficult to manage in late season. Do not plant cotton until cover crops and weeds are killed to prevent a 'green bridge' for early-season insects to move from the weeds to seedling cotton.

Soil Fertility

Cotton is very sensitive to soil fertility and production practices. It is important to supply all the nutrients that may be needed in each field. Many problems can be related either directly or indirectly to acid soils and low levels of plant nutrients. Fertilization and liming programs should be based on the fertility of the soil. A soil test is the first step in a sound fertility program. Samples should be collected during fall or early winter and sent to a soil testing laboratory for analysis and recommendations (Table 1).

Table 1. Fertilizer recommendations.

Soil Test Level	Phosphate (P ₂ O ₅) lbs/ac	Potash (K ₂ O) bs/ac
Low	90	120
Medium	60	90
High	30	60
Very High	0	0

Lime

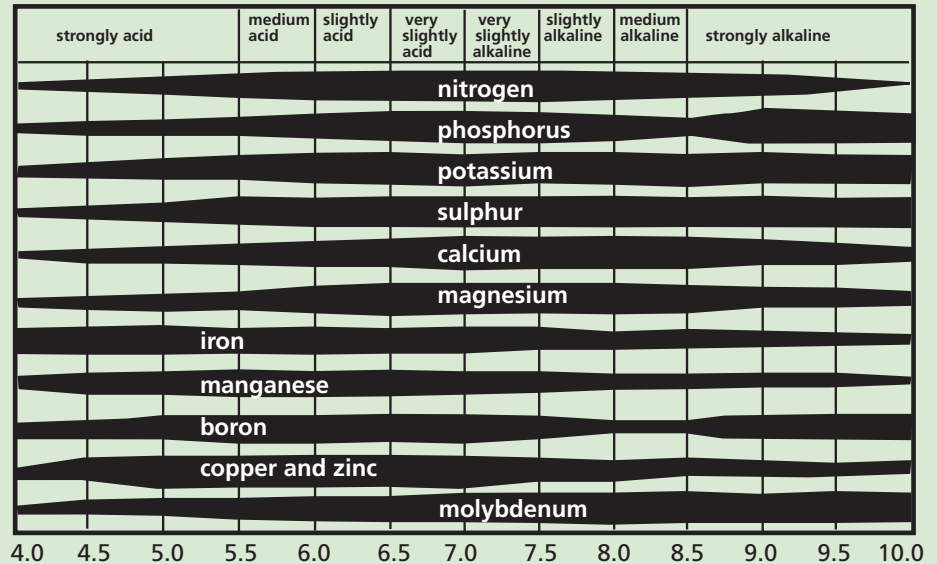
Yields will be highest and fertilizers used most efficiently when the soil pH is 6.0 to 6.5 (Figure 1). Calcium supplied by ground limestone aids in setting fruit and proper maturing of bolls. Soil acidity will also influence the availability of some plant nutrients, herbicide activity, seedling development and seedling diseases.

Applying high rates of acid-forming fertilizers will gradually lower the soil pH. A 100-pound per acre application of nitrogen in the form of anhydrous ammonia, ammonium nitrate or urea would require approximately 400 pounds of limestone to neutralize the acidity resulting from the nitrogen application.

Nitrogen

General nitrogen recommendations are based on research by University of Tennessee AgResearch and UT Extension. The amount of nitrogen needed depends on the soil and its previous cropping history. Generally, 60 to 80 pounds of nitrogen are needed on upland soils where excessive growth and late maturity are not a problem. On bottom soils or sites where excessive growth is a problem, 45 to 60 pounds of nitrogen should be considered.

The various nitrogen sources are similar in supplying nitrogen for plant growth. Nitrogen can be applied at or just prior to planting or may be split with sidedressing applications no later than *early square stage*. Nitrogen deficiency symptoms first appear on the lower leaves. The leaves of nitrogen-deficient plants become light green to pale yellow. As they age, shades of red develop and then they turn



Adapted from: http://www.avocadosource.com/tools/FertCalc_files/pH.htm

Figure 1. Nutrient availability at varying soil pH levels.

to brown. Leaves then dry out and shed from the plant. The entire plant will be stunted and weak in appearance and fruit set will be reduced.

Under nitrogen-deficient conditions, nitrogen can be applied to the soil as a side-dress application until about the third week of bloom. Foliar-applied fertilizer, while costly, can supply in-season nutrients for cotton plants. However, foliar fertilizer should not be the primary source of nutrient supply for the crop. Mid-season applications of nitrogen may increase the risk of excessive late-season growth and delayed maturity.

Phosphorous (P₂O₅)

The amount of phosphorous in a cotton plant is low compared to

levels of nitrogen and potassium. Phosphorous fertilization is important to cotton production, because it is essential for root development and early growth. Some cotton soils tend to be low in available phosphorous. Phosphorous is an immobile nutrient, so it must be available in the rooting zone for root contact and uptake into the plant.

Low phosphorous levels in the soil result in stunted plants. The leaves will be smaller than normal and dark green. Fruiting and maturity may be delayed, making the plant more vulnerable to insects and diseases. Low levels of phosphorous may reduce lint yield, fiber strength and micronaire. The availability of phosphate to the cotton plant is dependent on a good liming program, as pH levels below 6.0 or above 7.0 reduce its availability.

Potassium (K₂O)

Many soils on which cotton is grown are low in available potassium. It is not uncommon to see potash-deficient plants. Low levels of potassium cause stunted plants and leaves that fail to develop a normal green color. Mature leaves are often mottled after turning light yellowish-green, then reddish-brown between the veins of the leaf, before the discoloration spreads to the leaf margins. The tips and edges of the leaves curl downward. The leaves become reddish-brown, and are scorched and blackened by the time they are prematurely shed. Bolls are small, immature and may fail to open or only partially open. Lint yield and fiber properties are reduced.

The availability of potassium is influenced by the soil pH. Soil tests are necessary to determine both the lime and potassium needed for productive yields. In recent years there has been an increase in potassium deficiency symptoms in cotton grown in West Tennessee. Problem fields may have adequate levels of potassium in the top 6 inches, but a low level in the subsoil. In some cases the pH level was also low, helping create the deficiency. Additionally, periods of dry soil may limit uptake of potassium by the crop.

Boron (B)

Boron deficiency in cotton is more likely to occur on limed soil, particularly after heavy lime applications. Apply boron at the rate of 0.5 pound per acre when soil pH is above 6.0 or where lime is used. Boron can be applied in mixed fertilizer or preemergence herbicides. To obtain 0.5 pound per acre of boron, apply 2.44 pounds "Solubor" per acre. For foliar application, apply 0.1 pound boron beginning at early bloom, making three to five applications at weekly intervals. Some boron deficiency symptoms may be:

- Abnormal shedding of squares and young bolls.

- Ruptures at the base of squares, blooms or on the stem (peduncle) that supports the squares.
- A darkened area at the base of bolls, extending inside the boll (can be detected by cutting across the base of the boll).
- Mature bolls that are small, deformed and do not fluff normally.
- Death of the terminal bud and shortened internodes near the top of the plant.
- Dark green rings on leaf petioles ("coon-tail" petioles). When petioles are sliced, a discoloration of the pith can be seen in conjunction with the rings.
- Dark green, often thicker leaves. Leaves remain until frost and may also be difficult to chemically defoliate.
- Poor response to nitrogen and potassium fertilization.

Sulfur (S)

Sulfur is absorbed by roots in the divalent anion form (SO₄⁻²). While atmospheric sulfur (SO₂) is taken up and utilized by the aerial parts of higher plants, root-absorbed sulfur is much more important in plant health and nutrition. Sulfur is a constituent of some amino acids and ultimately, protein synthesis. Sulfur is also an important component of many co-enzymes and secondary metabolites. Inhibition of protein synthesis associated with sulfur deficiency leads to chlorosis (yellowing) of leaves similar to that of nitrogen deficiency. However, sulfur deficiency is equally associated with old and young leaves, where nitrogen deficiency is generally limited to older leaves. Soil test for sulfur content and apply fertilizer needs in areas where sulfur deficiencies are apparent or expected.

Fertilizer Recommendations

Fertilizer Placement

Research has shown that where soil fertility is high, broadcast application of fertilizer is just as effective as band application. If the soil fertility is low, best results would be obtained by broadcasting about one-half and banding one-half of the fertilizer.

General fertilizer recommendations: In the absence of a soil test, apply 60 to 80 pounds of nitrogen, 60 pounds phosphate (P₂O₅), 90 pounds of potash (K₂O) and 0.5 pound of boron (B) per acre at planting. Nitrogen may be split-applied one-half at planting and one half as side-dress.

Variety Selection

Cotton variety tests are conducted each year at multiple locations in Tennessee to obtain performance information, which is then used to assist the producer in selecting varieties to grow (see UT Extension PB1742, Cotton Variety Tests in Tennessee). Lint yield is the most important consideration in selecting a variety. Increased emphasis is being placed on fiber strength, length, length uniformity and micronaire. The relative yield of a variety is influenced by a number of conditions such as soil type, fertility, cultural practices, insect control, weather, etc. Selection of an early-maturing variety is important in Tennessee because of the relatively short growing season. Varieties that mature earlier perform well in most Tennessee growing environments.

Many cotton producers find obtaining and maintaining a good stand of vigorous plants a problem each year in at least some fields. Seed quality may help determine the rate of emergence, vigor and even the yield of a crop of cotton. Obtain all available information when selecting cotton seed. Make sure the seed has at least 80 percent germination and a cool test rating of at least 50 percent. Seed with a good vigor rating will germinate and grow under a wide range of soil

and field conditions. Also make sure the seed are treated with fungicide and insecticide seed treatments if you are not using an in-furrow fungicide and insecticide.

In-plant Technologies

Many factors are considered when making varietal selections, including the inclusion of value-added transgenic traits. Bollgard II, WideStrike, Liberty Link, Roundup Ready and Roundup Ready Flex are traits for either insect control or herbicide tolerance. All have strengths and weaknesses and are extremely important consideration for producers when selecting varieties to plant. However, these technologies are not the most important factors to consider in variety selection. In addition to yield potential and transgenic traits, other plant characteristics such as yield stability, maturity, fiber quality, lint turnout percentage, leaf pubescence (presence or absence of hairs), storm-proofness, and growth and fruiting habit should all be considered when choosing a variety. Producers are encouraged to plant new varieties and multiple technologies on their acres but at a conservative scale.

Planting Date

Satisfactory planting dates in Tennessee are April 20 to May 10. Weather conditions, soil type and the use of fungicides will help determine whether to plant early or late. Planting after May 20 will tend to reduce yields, require more insecticide applications and result in delayed harvest. The minimum temperature necessary for cotton seed germination is near 60 degrees, while optimum germination temperatures range from 85 to 95 degrees. With seed of average quality, the soil temperature should be 65 degrees or higher for good rate of emergence of healthy vigorous plants. Check soil temperature at a 2-3 inch depth at 8-10 a.m. for three to five days to make sure the seedbed has reached 65 degrees. Also, make sure warm dry weather is predicted for the next five days.

Table 2. Date and probability of a fall freeze by location.

Location	Probability		
	50%	25%	10%
Bolivar	11-Oct	31-Oct	18-Nov
Brownsville	8-Oct	5-Nov	30-Nov
Covington	26-Oct	12-Nov	26-Nov
Jackson	24-Oct	31-Oct	7-Nov
Martin	15-Oct	7-Nov	28-Nov
Memphis	6-Nov	13-Nov	19-Nov
Milan	17-Oct	7-Nov	26-Nov
Murfreesboro	13-Oct	4-Nov	25-Nov
Newbern	13-Oct	6-Nov	28-Nov
Samburg	15-Oct	6-Nov	25-Nov
Savannah	20-Oct	10-Nov	29-Nov

Table 3. Length of row need for 1/1000th of an acre.

Row Spacing (inches)						
7.5	10	15	30	36	38	40
row length needed for 1/1000th acre						
69' 8"	52' 3"	34' 10"	17' 5"	14' 6"	13' 9"	13' 8"

*Plant populations for UNR cotton should be evaluated by plants per square foot.

Rate and Spacing

Common row spacings are 30, 38 or 40 inches. For maximum efficiency in weed and disease control, harvesting, etc., establish a population of 30,000 to 60,000 plants per acre (Table 4). Excessive plant populations will cause higher fruiting on the plants, shorter limbs, smaller bolls and fewer bolls per plant. A stand of three to five plants per foot of row will require four to six seeds per foot of row under normal conditions. Table 4 will help determine the row spacing required to obtain a desired plant population.

Depth of Planting

After carefully calibrating the cotton planter to plant the desired number of seed, check the depth seed are placed. Set the planter to place seed 0.5 to 1.5 inches deep. The depth

will have to be rechecked when soil conditions change. Factors such as moisture, soil temperature, soil texture, crusting potential and type of seedbed should be considered. When planting 0.5 to 0.75 inch deep, take care to ensure the seed are covered to prevent injury from surface-applied herbicides. As the soil warms and moisture is lost, the seed may be planted 1 to 1.5 inches deep to allow planting in moist soil. Never plant cotton seed deeper than 1.5 inches.

Making Replant Decisions

Each year many producers are forced to replant cotton due to adverse conditions. Replanting is one of the most difficult decisions to make and second-guessing is very common.

Table 4. Plant populations at various row spacings.

Plants per foot	Row Spacing (inches)						
	7.5	10	15	30	36	38	40
Plants per Acre							
1.0	69,696	52,272	34,848	17,424	14,520	13,756	13,068
1.5	104,544	78,408	52,272	26,136	21,780	20,634	19,602
2.0	139,392	104,544	69,696	34,848	29,040	27,512	26,136
2.5	174,240	130,680	87,120	43,560	36,300	34,390	32,670
3.0	209,088	156,816	104,544	52,272	43,560	41,268	39,204
3.5	243,936	182,952	121,968	60,984	50,820	48,146	45,738
4.0	278,784	209,088	139,392	69,696	58,080	55,024	52,272
4.5	313,632	235,224	156,816	78,408	65,340	61,902	58,806
5.0	348,480	261,360	174,240	87,120	72,600	68,780	65,340

*Plant populations for UNR cotton should be evaluated by plants per square foot.

Calendar Date

The recommended planting window for Tennessee is April 20-May 10. Although boll weevil eradication, Bt cotton and early-maturing varieties may have extended the planting window, planting after May 20 is beyond the optimum planting window for high yields. A poor stand may be replanted on May 1 but will more likely be kept on May 20. Regardless of the advances in technology, an early freeze can be devastating to an immature crop (Table 2). Setting a two-bale crop on the plant and harvesting that same cotton are two different things.

Evaluate the Existing Stand

Go to at least 10 places within the field and measure 1/1000th of an acre. For example, 13 feet, 9 inches is 1/1000th of an acre for 38-inch rows. For more row spacings, see Table 3. Once the desired length has been measured, count the number of plants. Multiply the number of plants X 1,000 to determine your plant population per acre. Remember, go to several places and count not only the number of plants but also observe your stand for uniformity. Take note of any skips longer than 3 feet in length. Once this has been done, you then have

to make the decision about plants that will live and those that will die. If the plant has severe lesions on the stem and the plant is brittle, it will probably die. If the roots are discolored but remain white or green when the brown tissue is scraped away, it will probably live. Also, examine the plant terminal. How do the new leaves look? If there appears to be new growth emerging, the plant may live. If the plant looks sick and you can't make a decision, assume it will die. However, cotton has a tremendous ability to survive and compensate during the growing season if conditions improve.

How many plants are needed to make a crop?

Research has shown that cotton yields are similar when uniform populations of 20,000 to 70,000 plants per acre. Uniform populations are critical and fields with large skips may need to be replanted. What is the yield potential of the field? Fertile, bottomland fields may have more compensation ability than eroded, droughty hills. Remember when it's getting late in the planting season yield potential is decreasing every day. Uniform populations of 1 to 2 plants per foot (Table 4) may

not be ideal, but can be satisfactory provided the stand is UNIFORM.

What are your costs and what cultural practices have been used?

Sometimes replanting to cotton is not the best option. However there are several factors that will determine this decision. Has a residual herbicide been applied? Some herbicides like Cotoran, Caparol or Diuron will essentially lock you into cotton due to labeled re-plant restrictions. Is the land leased or under a gin contract? Lease agreements are often crop specific and offer no alternatives. Also, the type of rental agreement can play a role. Extremely high rent may not allow a grain alternative. Has fertilizer been applied? Another factor that has become more important in recent years is the technology fee. Before replanting, determine whether the additional technology fees will be rebated. Another factor to consider is if replanting to a different crop is that payments in the current Farm Bill are decoupled from production, thus payments are made regardless of crop planted.

Manage for earliness

Choose an early maturing variety with Bt technology if you decide to replant. If the stand was lost due to disease, use the full rate of fungicide when replanting and try to plant beside the old row. The old furrow will contain disease inoculum and conditions for disease can be worse than the initial planting. It is imperative to achieve a uniform stand with this planting because time is precious. Fields that are not replanted will likely be stunted. Fruit retention will be crucial, as time may not allow for late season blooms to mature. In addition to early square retention, timely mepiquat chloride (Pix, Pentia, Mepichlor, Mepex, etc.) or Stance applications will help improve earliness. If the stand is partially lost to hail, some of these plants with damaged terminals may lose apical dominance and become "crazy." This vegetative growth will need special care in order to achieve good fruiting and earliness. In cases when the decision to replant is made, match the correct nitrogen rate to the realistic yield potential of the late planted crop. Adding more

nitrogen than necessary will delay maturity and increase the potential for losses from late season weather changes.

Other points to consider:

Weather forecast. Does the 5 to 7 day forecast look promising? Will conditions be conducive to plant growth or rapid germination and emergence? Weather forecast can play a big role in replant decision making. If the decision to replant is made, destroy the old stand. Plants from the first planting will mature differently and will compete with the replanted population. Some control options are:

- 32-40 oz Gramoxone SL
- 32-40 oz Gramoxone SL + 32 oz Cotoran or Caparol
- 32-40 oz glufosinate (non-Liberty Link and non-WideStrike varieties only)
- 32-40 oz glufosinate + 32 oz Cotoran or Caparol

- 22-32 oz Glyphosate for Liberty Link or non-glyphosate cotton

Should the whole field or portions of the field be replanted? Spot re-planting is a means of reducing seeding costs and time. However, this often complicates crop management since several maturity ranges will be found within one field. If spot planting, try to block out parts of the field so that management inputs can be directed to larger areas. Also, choose varieties whose growth habits and maturity will closely follow the first planting.

Remember that cotton is very forgiving and you can make acceptable yields with a late planted crop. Once you make the decision to either replant or not you must believe that you have made the correct decision and do everything to ensure its success. A common rule of thumb among most university Extension specialists is "If the decision to replant is difficult, then there are probably enough plants to keep the stand."

Plant Growth Regulators

Plant growth regulators (mepiquat chloride) may reduce boll rot and excessive vegetative growth. The use of mepiquat chloride may result in one or more of the following: height reduction, shorter limbs, more open canopy, better boll retention, less boll rot, improved defoliation and a darker green leaf color. Together, these effects shift a greater proportion of boll production to lower nodal positions than in untreated cotton. This shift can lead to earlier cutout and maturity of the crop, which is often beneficial to cotton grown in short-season environments like Tennessee. Mepiquat-type plant growth regulators (PGRs) are products containing mepiquat chloride (such as Pix, Mepex or Mepichlor), mixtures of mepiquat chloride with other materials (such as Pix Plus, Mepex Plus or Pix Ultra), or other mepiquat-based compounds (Pentia).

Applying mepiquat-type PGRs to cotton alters the internal hormone balance of the plant. Specifically, the mepiquat ion reduces plant synthesis of gibberellic acid by partially inhibiting one of the enzymes involved in its synthesis. One of the roles of gibberellic acids in plants is to promote cell expansion during growth, which is limited by cell wall development. Cell walls exposed to mepiquat develop and harden faster, so cells do not expand as much as untreated cells. The smaller cells in growing shoots of cotton result in shorter internodes in stems and branches. Therefore shoot growth is more compact if mepiquat-type PGRs are applied. Larger plants require a higher application rate to achieve similar growth prevention. In plant concentration of mepiquat ion may be reduced by growth dilution, which is observed as plants "grow out of" earlier mepiquat applications. Table 5 indicates plant growth vigor at different stages of development.

The producer has the option of a single, dual, or up to four low-rate multiple applications of mepiquat chloride. When cotton is under stress from dry soil conditions, disease, herbicide injury or fertility stress, the application of mepiquat chloride should be avoided. Wait for rain to reduce plant stress or treat to reduce insects before treating with mepiquat chloride.

Mepiquat chloride can be applied using either water or oil as a diluent. When using water, apply at least 3 gallons per acre by air or 10 gallons with ground equipment. Thorough coverage of the cotton foliage is required. When using oil as a diluent for ultra low volume (ULV) aerial application be sure to use a non-phytotoxic oil concentrate with either a petroleum or vegetable oil base. Follow the mepiquat chloride label closely for purchasing oil and mixing instructions. The use of a good quality surfactant with mepiquat chloride application can reduce the rain-safe period from

eight to four hours. Mepiquat chloride has an aqueous base and is compatible with most insecticides and miticides. Compatibility can be checked by adding a teaspoon of insecticide or miticide to 1 pint of ready-to-use spray solution of mepiquat chloride.

Restrictions and Limitations

- Do not make a single application of 0.5 to 1 pint of mepiquat chloride to cotton that is drought stressed. If using the low rate multiple option, discontinue use until the moisture stress is alleviated.
- Do not apply more than 3 pints of mepiquat chloride per acre per season.
- Do not apply mepiquat chloride within 30 days of harvest.
- Do not graze or feed cotton foliage to livestock within 30 days of application, or after applying mepiquat chloride in oil as a ULV application by air.
- Do not tank mix with other products other than mentioned on label.
- Do not apply mepiquat chloride through any type of irrigation system.

Under good growing conditions a common approach is to apply mepiquat early and follow up 10 to 14 days later with another application. Then, after you have developed a fruit load aiding plant growth control then make a second application during early bloom. The best advice is to get plant growth under control prior to bloom. However, a single application of 12 to 16 oz is effective at early bloom then followed up as needed (Table 6). At bloom applications should work well in most situations. For vigorous varieties that can get rank in good growth environments, a low rate (2 to 4 oz broadcast) application at early match-head square with follow up applications based on plant vigor should suffice. The at-

bloom treatment will also work well with these varieties. Some varieties are much less aggressive and a single at bloom application will likely suffice for growth control. However, under certain growing conditions all varieties will need growth control and situations like poor fruit load, later planting date, or excessive

nitrogen fertility will require a more aggressive approach. A good rule of thumb is to make applications based on field history, plant vigor, variety, fruit load and weather forecast. Remember, growth control should take place before and during early bloom. PGRs can do a lot of things, but they can't shrink the plant.

Table 5. Height to node ratios for cotton PGR decisions. (Jost et al. 2005)

Growth Stage	Normal	Stressed	Vegetative
HNR (inches/node)			
Seedling	0.5-0.75	-	-
Early Squaring	0.75-1.2	0.7	>1.3
Large Square - First Flower	1.2-1.7	<1.2	>1.9
Early Bloom	1.7-2.0	<1.6	>2.5
Early Bloom + 2 weeks	2.0-2.2	<1.8	>2.5

Adapted from: Jost, P., S. M. Brown, S. Culpepper, G. Harris, B Kermerait, P. Roberts, D. Shurley, and J. Williams. 2005. 2005 Georgia Cotton production guide p 37-39.

Table 6. Plant growth regulator application strategies.

Single or Dual Application	Rate per acre	Mepi- Stance
	quat	quat
First Application Apply when cotton is actively growing and is between 20" and 30" tall, provided cotton is not more than 7 days beyond early bloom stage (5-6 blooms per 25 row feet). If cotton is 24" tall and has no blooms apply Mepiquat chloride plant regulator. Use 2 pints per acre on cotton where excessive vegetative growth is not likely to be a problem, and 1 pint per acre in areas tending to have excessive vegetative growth.	0.5-1.0 pint	2.0-3.0 oz
Second Application Field has a history of excessive growth, and/or conditions after the first application are favorable for excessive growth, apply a second application 2 to 3 weeks after the first application.	0.5 pint	2.0 oz
Multiple Low-rate applications	<i>Mepiquat</i>	
First Application Match head square stage of growth.	2.0-4.0 oz	
Second Application 14 days later, or when excessive regrowth occurs.	2.0-4.0 oz	
Third Application 14 days later, or when excessive regrowth occurs.	2.0-4.0 oz	
Fourth Application 14 days later, or when excessive regrowth occurs.	2.0-4.0 oz	