# Plant Growth Regulators in Cotton

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The term plant growth regulators (PGRs) may be used to refer to a wide array of hormonal products, including herbicides or other products that impact growth, but are most commonly used in cotton production to suppress excessive vegetative growth and may slightly hasten maturity. The products function by partially inhibiting the hormone gibberellic acid (GA), which is responsible for cell wall elasticity. This temporary inhibition of GA results in decreased internode length, or the space between two consecutive main stem nodes on the plant. Inhibition of GA will impact any area of the plant where cells are actively expanding; therefore, PGRs will only affect actively growing portions or new growth occurring after application. Activity in the plant usually lasts for the time it takes for two to four nodes to form, depending on the rate applied. Correct use of PGRs will produce plants with a more compact set of main stem nodes, shorter plants and allows the white flower to reach the terminal more rapidly than nontreated plants so that cutout may be achieved earlier (see the fact sheet PSS-2181 Defining Cutout in Cotton for more information). For the purpose of this fact sheet, the rate recommendations will be based on a mepiquat chloride product containing 0.35 pounds of active ingredient per gallon. More information about other formulations, including use rates is outlined in Plant Growth Regulator Use in Oklahoma Cotton.

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**facts.okstate.edu**

## Factors Impacting the Need for Regulating Plant Growth

The need for a PGR often is based on current visual observations of crop growth or conditions, i.e. if the plants look too tall, then a PGR should be applied. Unfortunately, this method sometimes results in an application occurring too late for optimum growth regulation. Since PGRs only impact new growth, it is critical to base this decision upon the potential for excessive growth to occur. This means that while the size of the plant may dictate use rate (higher rates on larger plants, lower rates on smaller plants to achieve the same level of growth regulation), PGRs have no effect on growth that has already occurred. In addition to taking into consideration the current growth stage and size of plants, the factors shown in Table 1 also should be used to guide PGR decisions.

**Table 1. Factors for using plant growth regulators.**

| *Factor* | *Considerations* |
|---|---|
| Variety | Generally, early maturing varieties require a less aggressive PGR strategy than late-maturing varieties. However, the actual approach will be governed by many factors listed below. Most seed companies offer PGR guidelines for all their variety offerings. |
| Fruit Retention | Whether squares or bolls, fruit retention is the most effective plant growth regulator for cotton. Environmental conditions or insect feeding that result in fruit shed may necessitate earlier applications or increased rates. |
| Weather Forecast | If conditions favoring excessive vegetative growth are forecasted, a PGR application may be required or rates may need to be increased. The timing and rate should also consider variety and fruit retention. |
| Irrigation | Growth potential is greater in irrigated cotton, thus PGR applications to irrigated cotton are common. Applications in non-irrigated cotton are not as common but may be needed if favorable conditions (heat and moisture) persist, or if the crop experiences a large fruit shed. This is especially true for late-maturing varieties, which are commonly selected for dryland production. Rates in non-irrigated cotton are often lower to avoid premature cutout if a forecasted rain event deteriorates or precipitation totals are lower than predicted. |
| Nitrogen | If adequate or excessive fertility levels are present, whether residual or applied in-season, a more aggressive PGR approach may be required. Excessive nitrogen can result in rank vegetative growth, slow the initiation of fruiting and delay maturity. Excessive nitrogen in combination with optimum moisture conditions and warm temperatures can result in particularly vigorous vegetative growth. |

## Scheduling PGR Applications in Cotton

There are many opinions regarding the scheduling of PGR applications in cotton, but evaluating the growth potential of the crop is likely the best option. This involves examining the internode length between the fourth and fifth nodes counting down from the terminal. This internode is used because it represents that newest portion of the plant that is fully expanded and reflects the growth potential of the plant. The greater this internode distance is, the more growth potential the plant has, assuming conditions continue to be favorable and no other factors affecting growth (fruit shed, insect pests, disease, nutrient deficiency, etc.) are present. Depending on producer preference, an internode length between the fourth and fifth node reaching 2 to 3 inches may be the trigger point for a PGR application. The actual amount of distance that prompts a PGR application will depend on the production factors listed above as well as the seven- to 10-day forecast.

Another method is evaluating the number of nodes above the uppermost first position white flower (NAWF). If the crop is at eight to nine NAWF or greater during the early bloom period, then a PGR application should be considered to help control vegetative growth and achieve timely cutout. Monitoring both the internode length and NAWF value is an excellent method of monitoring growth potential and the balance between vegetative growth and fruiting potential in the crop. The number of NAWF that triggers a PGR application will lower as the flowering period progresses. For example, by the fifth or sixth week of bloom seven or fewer NAWF values may trigger an application, particularly if favorable growing conditions are present.

The amount of internode elongation or plant height that is allowed prior to requiring a PGR application will vary from location to location and depends on producer preference, management practices and harvest method. Irrigated cotton that is stripper harvested may be on a stricter PGR schedule, requiring more applications and/or higher rates than picker-harvested irrigated cotton. There is more forgiveness for irrigated cotton if forecasted rain fails to materialize, as the crop can be “irrigated out” of the effects of a PGR application to avoid reaching cutout prematurely. Further, height control is typically of greater concern because strippers have more issues harvesting taller plants (higher than 36 inches) than pickers.

Another method frequently used to schedule PGR applications is based on the plant growth stage, often referred to as the Low Rate Multiples (LRM) strategy. In this method, applications are often initiated earlier in the season (pinhead or matchhead square) but use lower rates with an increased frequency of application. This method is often utilized in short season stripper harvested irrigated cotton where both height control and maturity enhancement are priorities.

## Application Rates

The rate of PGR applied will often depend on what schedule is selected. With the LRM strategy, 2 to 8 ounces per acre of mepiquat chloride is a common range during the early squaring stages. Increased rates are dependent on crop size, growth stage and environmental factors. For instance, applications during the first half of the flowering period often range from 12 to 16 oz per acre depending on management, variety, and environmental conditions.

It is important to note that the magnitude of plant growth regulation is governed by the concentration of mepiquat in the plant. Higher use rates are required to achieve the same level of growth control on older, larger plants than is accomplished by lower use rates on younger, smaller plants. The maximum use rate per application is 24 ounces per acre, while the maximum in-season use rate is 48 ounces per acre. There is also a 30-day pre-harvest interval for mepiquat chloride.

## Other PGR Effects

Because PGRs inhibit gibberellic acid throughout the plant, any areas in which cells are expanding are impacted. This not only includes the main stem but leaves as well. As a result, leaf expansion is reduced following PGR application, producing smaller but thicker leaves. This results in leaves that are darker green following a PGR application when compared to plants that have not received a recent application, and is often referred to as the “Pix effect” but has no impact on crop health.



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