

**REGULATING TURF GROWTH**  
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Turf growth regulation is fast becoming a required fundamental practice (along with watering, fertilization, pest control measures, soil conditioning, and mechanical mowing) in the maintenance of turf. Advances in turfgrass growth regulator development now permit the "*management*" of shoot growth while improving turf performance (better rooting, stand density, color, food reserves, etc.). Lateral growth can be promoted while reducing rank vertical shoot growth (eg. clippings). Today we have the tools necessary for *managing* the timing, amount, and characteristics of turf growth. From a practical perspective, it is possible to enhance turf quality and performance while providing a cost effective means of managing clipping production and disposal.

**Types of Turf Growth Regulators.**

Turfgrass growth regulators can be classified into four distinctly different groups **Class A, B, C, or D.**

**Class A** turfgrass growth regulators interfere with the production of gibberellins *late* in their biosynthetic pathway and are useful on moderate to intensively managed turf areas. Primo (trinexapac-ethyl) is a Class A turfgrass growth regulator taken into the plant through the shoot.

**Class B** turfgrass growth regulators interfere with the production of gibberellins *early* in its biosynthetic pathway. These compounds can also be used on moderate to intensively managed turf, but their usefulness can be limited by the degree of turf bronzing that often accompanies foliar growth suppression. Uptake through the root systems also places restrictions on their effective use during turf establishment from seed, sod, or sprigs. Flurprimidol and Paclobutrazol are Class B turfgrass growth regulators.

**Class C** turfgrass growth regulators prevent cells from dividing (mitotic inhibition), thus temporarily stop new growth. Excellent seedhead control is often possible with Class C turf growth regulators, however, turf color and recuperative potential can be diminished. Maleic hydrazide, Mefluidide, and Amidochlor are Class C turfgrass growth regulators.

**Class D** turfgrass growth regulators induce a phytotoxic response resulting in a type of controlled injury that slows growth. Discoloration and safety margins are key issues with this type of PGR. Glyphosate, Chlorsulfuron, Ethofumesate, and sulfometuron-methyl are Class D turfgrass growth regulators.

**Highlights of Recent PGR Research Findings**

Ciba continues a comprehensive turf growth regulation research and development program including a cooperative role for studies at major universities throughout the United States. Illinois turf scientists have examined the impact of Class A regulation on turfgrass food reserves and root growth. Bentgrass food reserves (ie. carbohydrates) increased (two-fold over untreated turf at six weeks after treatment) following Class A PGR application. This increase was found in the root system, which is not a typical storage site in the turf plant. Bentgrass rooting was also found to increase while under Class A regulation. Better rooting is important for optimizing turf stress tolerance, particularly under heat (summer) and desiccating (summer and late-winter) conditions. Similar carbohydrate research has also been conducted in California, Texas, and Wisconsin. Additional rooting investigations on bermudagrass, Kentucky bluegrass, and tall fescue have been completed in Texas and Virginia.

Research findings over the past two years have indicated a role for PGRs in the pre-stress conditioning of turf. University turf scientists have found both less water use and improved turf performance under droughty conditions for Class A regulated turf as compared to other Classes of regulators or unregulated turf. PGRs

reduced the water use rates of tall fescue (California) and creeping bentgrass (New York). Class A regulation produced a water savings of 26% in 1995 for creeping bentgrass. Improved turf color, density, and quality under restricted water availability has been found (California, Texas, and New York). It is important to note that PGR applications in these studies was prior to the development of water stress conditions.

A two-year investigation in Michigan removed uniform divots weekly for several weeks from bentgrass (fairway conditions) and monitored recovery. The time to 95% closure of the divots for regulated turf was the same as controls in 1994. In 1995, Class A regulated turf reached closure in only 38 days as compared to 45 days for untreated controls, and 49 days for Class B regulation. This study also examined turf quality under wear. The turf quality following wear was improved for Class A regulated turf, particularly under a lower nitrogen regime.

Space does not permit a discussion of all recent and ongoing PGR research. Other findings worth watching for include *Poa annua* conversion (Wisconsin, Pennsylvania, Virginia, Ohio), *Poa annua* cold tolerance (Wisconsin), Aerification (New Jersey, Georgia), sod establishment (Virginia, Michigan, Mississippi), overseeding establishment (Texas, Pennsylvania, Florida), fertilization interactions (South Carolina, Michigan, Ohio), physiological aspects (Iowa, Kansas, Michigan, California, Illinois), and thatch (Illinois, Wisconsin).

### **Practical Uses of Growth Regulation.**

Today, turf growth regulators have found their place in many kinds of turf areas. Turf growth regulators can play an important role in both establishment and longer-term maintenance programs. Mowing is more difficult and often disrupts surface uniformity under the high soil moisture conditions associated with establishment from sod, sprigs, or seed. Class A regulation can permit the use of nitrogen to speed lateral establishment while managing the vertical growth of the establishing turf. Class A regulation can permit a new cultivar or species a better opportunity for establishment. Research and field use have demonstrated enhanced establishment of winter overseeding.

PGRs have been very successfully used to make mowing easier, less time consuming, and to manage turf foliar growth to minimize clipping management difficulties. Periods of rapid and rank shoot growth slow mowing and increase the wear and tear on equipment. Clipping pick-up (use of buckets, blowing, raking, sweeping, bagging, double cutting, etc.) can take as long as the mowing process and clipping disposal is an increasing problem. Reductions in mowing effort results in time and labor savings for more effective management of resources elsewhere on the grounds. Growth regulation has been particularly successful for superintendents who are trying to enhance turf quality and performance, while solving the clipping management problems on fairways.

As a new turf growth regulator, Class A regulation has created new opportunities for successful turf management and conditioning. Community constraints and the cost of clipping disposal will continue to impact turf management. PGRs have become an increasingly important tool for managing turf shoot growth while optimizing turf quality and performance.