Turf Growth Regulation

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Turfgrass Slide Monograph
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Introduction

• Plant growth regulators (PGRs) have been used on turfgrass areas for more than 50 years. Slowing turfgrass vertical growth and seedhead suppression on low-quality turf areas were the initial primary uses of PGRs. There was little PGR use on high-quality turf areas like golf courses because the PGR products initially available could be phytotoxic to the turf.
• PGR use has increased greatly in recent years due to the development of new, safer PGR products, and they are now a key part of many turfgrass management programs.
• The goal of this presentation is to provide an overview of current PGR use with a focus on high quality turf areas.
Information Sources

• Our understanding of PGRs is the result of extensive university research and practical applications discovered by turf managers. Several research projects have investigated PGR effects on plant physiology and morphology, which may be beyond the scope of this slide set.

• All of the PGR uses in this overview have been tested scientifically and/or evaluated by numerous turf managers. Data will be presented to support some uses but not all.

• The goal is to provide an overview of the different PGR uses, with the understanding that results will not always be consistent due to differences in turf management plans, environment, species, and cultivar, etc.
Information Sources


• Plant Growth Regulator Society of America (PGRSA)
Other PGR Information Sources

- University research reports
- Scientific publications
- Trade publications
- Info from manufacturers and distribution sales reps
- Discussions with other turf managers
- Internet chat rooms and websites
- The TGIF is an excellent central resource for all areas of turfgrass research and management.
In today’s turf management, growth regulators are used in an array of turf settings.
What is a Turf Growth Regulator?

An organic compound, natural or synthetic, that when present (or applied) in small amounts results in a change in plant growth and/or development.

**Change** = Better color, increased density, fewer clippings, no seedheads, enhanced establishment, improved recuperative potential, deeper roots, larger food reserves, etc.
Plant Growth Regulator Development

- Growth regulators for turf have been used since the 1950s.
- Pre-1980s: Mefluidide developed—it slows turf growth by slowing cell division.
- 1980s: Flurprimidol and paclobutrazol developed—they slow cell elongation by slowing the production of all forms of gibberellic acid (GA).
- 1990s: Trinexapac-ethyl developed—slows turf growth by slowing the production of GA1, the final form of GA. All other 120+ forms of GA that lead to formation of GA1 are not affected.
- 1990s: Ethephon research on turf initiated—slows turf growth by generating the plant hormone ethylene.
- 2000s: Experimentation with mixing different PGRs initiated.
PGRs Impact Natural Plant Hormones Levels

- **Abscisic Acid**: closes stomates and inhibits germination, gibberellic acid (GA), and cytokinins
- **Auxins**: apical dominance, cell enlargement, root growth, inhibits axillary buds
- **Cytokinins**: cell division and enlargement, flowering senescence, and inhibits auxin
- **Ethylene**: stimulated by stress, root growth
- **Gibberellins**: cell elongation, photoperiod response, and chilling tolerance
- **Polyamines**: increase growth and slow chlorophyll degradation
The Ideal Turf Growth Regulator

- Slows vertical growth
- Inhibits seedheads
- Results in no decrease in turf recuperative potential
- Improves turf quality
- Provides economic savings by reducing mowing and labor cost
- Delivers consistent performance
- Acts on all major turf species
Old PGR Classification

- PGRs were originally classified as Type I and Type II.
- Type I PGRs included products that slow turf growth and seedhead development by slowing cellular division.
- Type II PGRs included products that slow turf growth by reducing the amount of the plant hormone gibberellic acid, which plays a role in cell elongation.
- As additional products were developed, a new PGR classification was proposed to further differentiate mode of action by uptake site and how the PGRs influence plant development.
New PGR Classification

- Class A: Late GA Synthesis Blockers
  trinexapac-ethyl
- Class B: Early GA Synthesis Blockers
  paclobutrazol, flurprimidol
- Class C: Mitotic Inhibitors
  maleic hydrazide, mefluidide, amidochlor
- Class D: Herbicidal with PGR Activity
  sulfometuron-methyl, glyphosate, chlorsulfuron, ethofumesate
- Class E: Ethylene Production Enhancement
  ethephon
- Class F: PGR Combinations
  trinexapac-ethyl + flurprimidol, trinexapac-ethyl + ethephon