PGRs: How GDDs Affect Scheduling

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Trinexapac-ethyl and Plant Health

- Increased Water Use Efficiency
  - Slightly Lower ET (King et al., 1997; Marucci and Lang, 1998; Ervin and Kool, 2001)
  - Increase Salinity Tolerance and Improved Dry Down
    - (Jiang and Fu, 1998; Presser et al., 2006)
- Improved Heat Stress Tolerance
  - More Stress Hormones and Antioxidants (Ervin and Zhang, 2002)
  - Increase Sod Storage Life in Heat (Westman et al., 2002 & 2003)
- Improved Heat Stress Tolerance
- Increased Non-structural Carbohydrates
  - During Suppression Phase Only
    (Kim et al., 1998 & 2000; Rathe 2001; and Ervin and Zhang, 2007)

What is a Plant Growth Regulator

- A natural or synthetic compound that alters plant growth rate
  - Plant Hormones
  - Plant Growth Regulators/Herbicides
  - Biostimulants
- Class A to F
  - Class A and B inhibit synthesis of plant growth hormone Gibberellin (GA)
    - Trinexapac-ethyl (Primo Maxx), Prohexadione-Ca (Aneuw)
    - Paclobutrazol (Trimmit), Flurprimidol (Cutless)

How do PGRs Inhibit GA Syntheses?

Class B PGRs Inhibits the Pathway Here
Biosynthetic Pathways Are Just Very Small Assembly Lines Inside Cells

Class A PGRs Inhibits the Pathway Here

The Big Problem With PGR Use

It's Hard To Know If They Are Working

Primo Maxx Treated
Non-treated Control

Labels Can Be Vague

Example: 2008

The rates presented in the Application Rate Table provide approximately 50% growth inhibition over a 4-week period with little or no discoloration of turf growing under favorable conditions.

For extended growth suppression up to 8 weeks, when temporary discoloration can be tolerated, a maximum of twice the recommended Primo MAXX rate from the Application Rate Table may be applied.

Rate Can Be Legally Increased 100%

Application Timing
Apply Primo MAXX to actively-growth turf if turf is going into dormancy because of high or low temperatures or lack of moisture, apply a lower rate of Primo MAXX.

Repeat applications of Primo MAXX may be made as soon as the turf resumes growth or more suppression is desired, but do not apply more than 7.0 fl. oz./1,000 sq. ft. per year.

Primo Maxx Can Be Re-applied as Often as Desired
PGR Metabolism

- Decreased Efficacy During Summer
  - Lickfelt et al. (2005)
  - Beasley and Branham (2007)

- TE Metabolism Directly Related to Air Temperature (Beasley and Branham, 2005)
  - 6.4 Day Half Life at 64°F (18°C)
  - 3.1 Day Half Life at 86°F (30°C)

**Doubling Temperature (°C) Doubles TE Breakdown**

Growing Degree Days System

- Air Temperature Predicts TE Re-application intervals

**Calculating GDD**

- By Hand:
  - Get Yesterday’s Average Temperature
  - Convert to Celsius
  - Add Temperatures

- Use GDD Tracker and New App
  - EASY!!!

Creating Primo GDD Model

- Primo Applied to Creeping Bentgrass Research Green
- Collected Clippings Daily
- Re-applied Primo at Various GDD Thresholds or Every 4 Weeks
- Observe Which Threshold Provided Consistent Growth Suppression
What About Application Rate?

Primo Maxx Re-applied Every Four Weeks

200 GDD TE At 1x and 2x Rates

Shrinking the Interval Increases the Magnitude of Growth Suppression
Use GDD To Increase TE Precision

- Calendar Based PGR Applications Inefficient
- Re-apply TE (Primo Maxx) Every 200 GDD
  - BASE TEMP: 0°C
  - Reset to 0 When TE is Re-applied
  - Maintains Yield Suppression Phase Regardless of Temperature
- Application Rate Not Important
  - Double labeled rate (0.25 fl oz/M) same duration and amount of growth suppression

Why Doesn’t App Rate Matter?

The Mowing Height Effect

- PGRs More Effective on Higher Turfgrass
- Less Growth = Less Recuperative Potential
- Avoid Spraying PGRs on Wear Stressed Collars

Potential Solution

- Light N Applications to Increase Growth Rate
  - Relative Growth Suppression Unaffected, However
- Last Resort: Spray affected areas with product containing GA to cancel out PGR

Suppression and rebound with 6 week paclobutrazol (Trimmit) applications

GDD accumulation predict paclobutrazol putting green performance
GDDs and Trimmit on Greens

325-350 GDD (Base 0°C) Maintains Bent Suppression Hurts Poa Annu

Comparing Plant Growth Regulator Performance on Bentgrass Greens

Trimmit

Primo

Likely Rate Response with Paclobutrazol

11oz Trimmit + 5.5 oz Primo Maxx
5.5 oz Trimmit + 2.7 oz Primo Maxx

Prohexadione-Ca (Anuew) lasts longer than trinexapac-ethyl

200 GDD Primo Maxx
300 GDD Anuew
**Prohexadione Ca (Anuew) lasts longer than trinexapac-ethyl**

**PGR and Putting Green GDD Results**

- **GDDs predict PGR breakdown**
- **GDD Intervals for greens (base 0°C)**
  - Trinexapac-ethyl: 200 GDD (18%)
  - Prohexadione-Ca: 300 GDD (21%)
  - Paclobutrazol – 5.5oz/Acre: 250GDD
  - Paclobutrazol – 11oz/Acre: 350GDD (45%)
  - Class A + Class B: Use Class B GDD
- **Maintain suppression or don’t use PGRs**

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**New GreenKeeper™ App Arriving this Spring**

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**Note:**

- Relative Clipping Yield (% Control)
- Trimmit (11 oz/A)
- Anuew
- Primo Maxx