PGRs: How GDDs Affect Scheduling

Bill Kreuser
http://turf.unl.edu/
University of Nebraska Lincoln

What is a Plant Growth Regulator

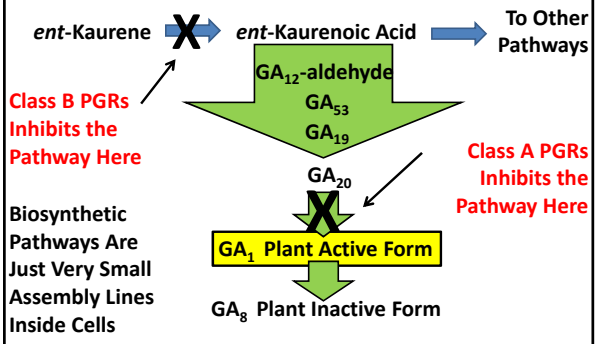
- A natural or synthetic compound that alters plant growth rate
  - Plant Hormones
  - Plant Growth Regulators/Herbicides
  - Biostimulants
- Class A to F
  - Class A and B inhibit synthesis of plant growth hormone Gibberellin (GA)
    - Trinexapac-ethyl (Primo Maxx), Prohexadione-Ca (Aneuw)
    - Paclobutrazol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

Trinexapac-ethyl and Plant Health

- **Increased Water Use Efficiency**
  - Slightly Lower ET (King et al., 1997: Marcum and Jiang, 1998; Ervin and Koski, 2001)
  - Increase Salinity Tolerance and Improved Dry Down
    - (Jiang and Fry, 1998; Pessarakli et al., 2006)
- **Improved Heat Stress Tolerance**
  - More Stress Hormones and Antioxidants (Ervin and Zhang, 2003)
  - Increase Sod Storage Life in Heat (Heckman et al., 2001 & 2002)
- **Improved Heat Stress Tolerance**
- **Increased Non-structural Carbohydrates**
  - During Suppression Phase Only

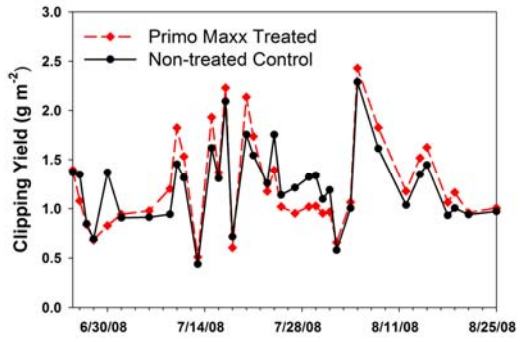
(Han et al., 1998 & 2004; Richie 2001; and Ervin and Zhang, 2007)

How do PGRs Inhibit GA Syntheses?



The Big Problem With PGR Use

Its Hard To Know If They Are Working



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.

Excessive turf growth, which may occur with high fertilization or during spring flushes, may require higher rates of Primo MAXX. Under these conditions, Primo MAXX rates may need to be increased up to 50% to provide an adequate length of control.

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.

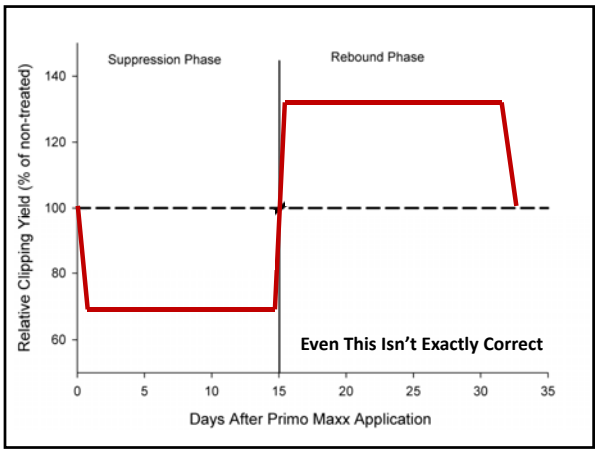
Rate Can Be Legally Increased 100%

Application Timing

Apply Primo MAXX to actively-growing 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.

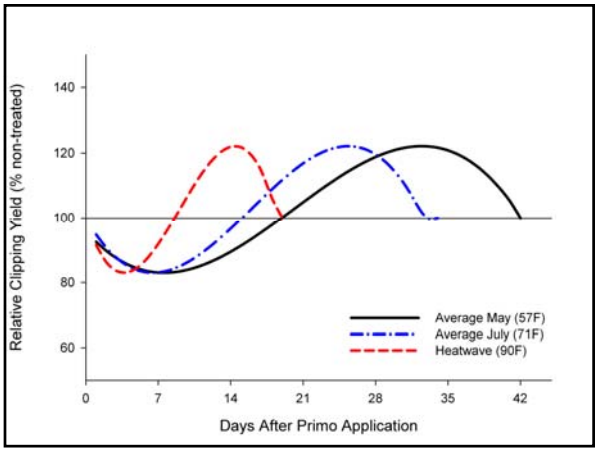
Primo Maxx Can Be Re-applied as Often as Desired



PGR Metabolism

- **Decreased Efficacy During Summer**
  - **Lickfelt el 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)**

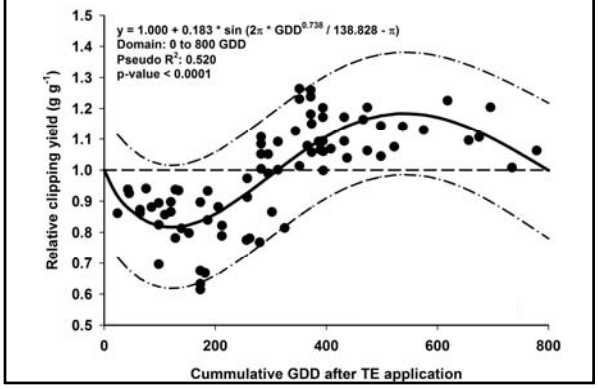
Doubling Temperature (°C) Doubles TE Breakdown



Growing Degree Days System

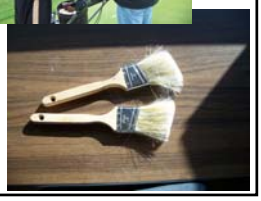
- **Air Temperature Predicts TE Re-application intervals**
- **Calculating GDD**
  - **By Hand:**
    - **Get Yesterday's Average Temperature**
    - **Convert to Celsius**
    - **Add Temperatures**
  - **Use GDD Tracker and New App**
    - **EASY!!!**

Trinexapac-ethyl (Primo Maxx) GDD Model

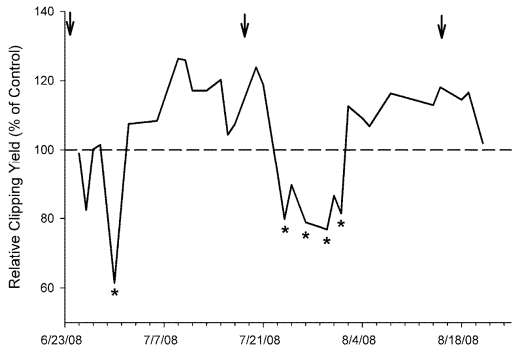


Creating Primo GDD Model

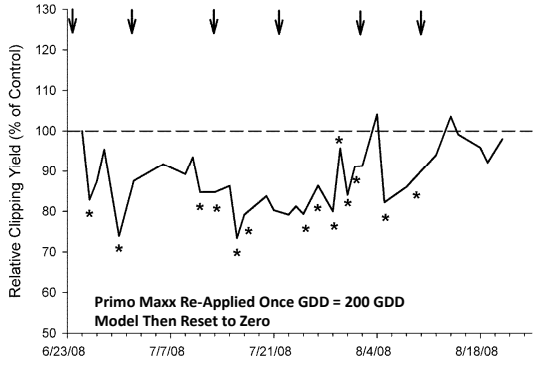
- Primo Applied to Creeping Bentgrass Research Green
- Collected Clippings Daily
- Re-applied Primo at Various GDD Thresholds or Every 4 Weeks
- Observe Which Threshold Provided Consistent Growth Suppression



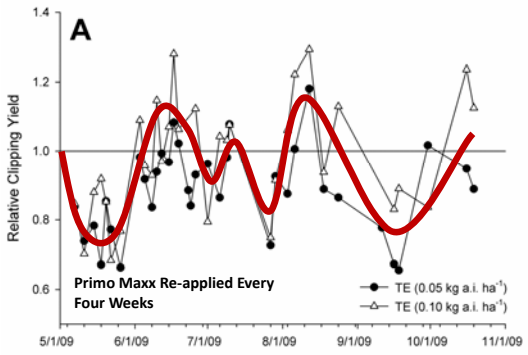
Four Week TE Applications



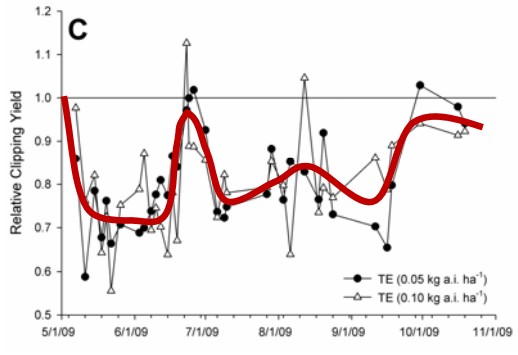
200 GDD TE Applications



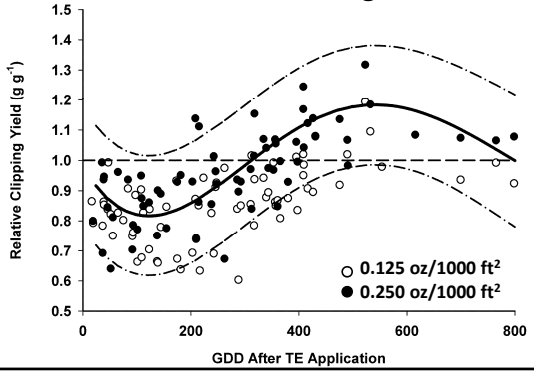
What About Application Rate?



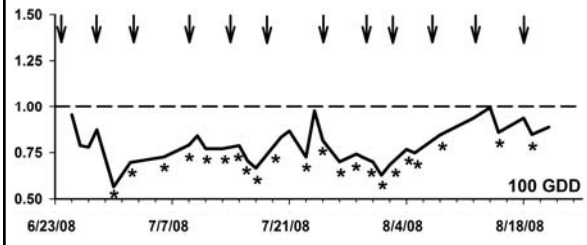
200 GDD TE At 1x and 2x Rates



Trinexapac-ethyl Rate Didn't Affect Performance on Putting Greens



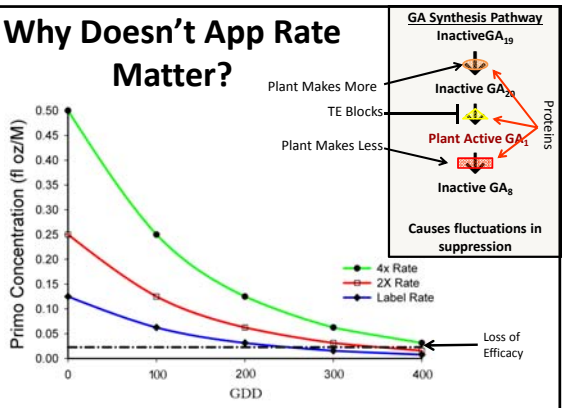
Shrinking the Interval Increases the Magnitude of Growth Suppression



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

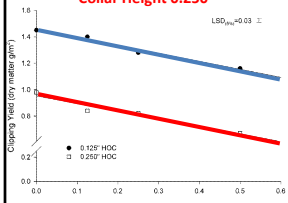
Why Doesn't App Rate Matter?



The Mowing Height Effect

Actual Clipping Yield

Collar Height 0.250"

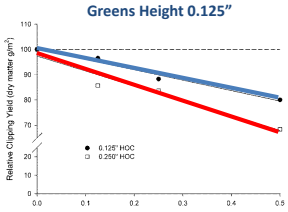


Primo Maxx Application Rate

Collar Height Grass Grows 50% Slower Than Greens Height Grass

Relative Clipping Yield

Greens Height 0.125"



Primo Maxx Application Rate

More Relative Yield Suppression on Collar Height Grass Than Greens

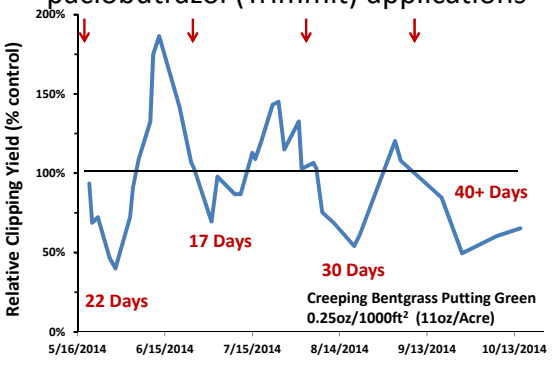
Implications for Summer Collar Decline

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

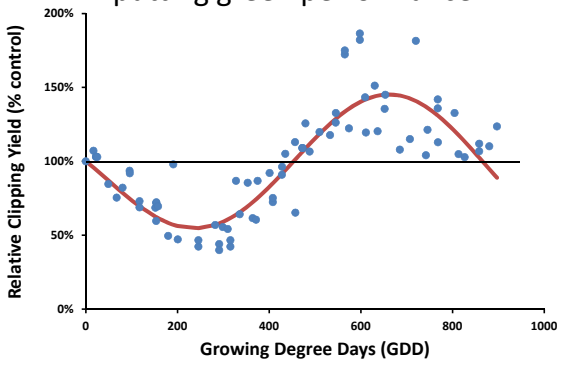
Potential Solution

- **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**

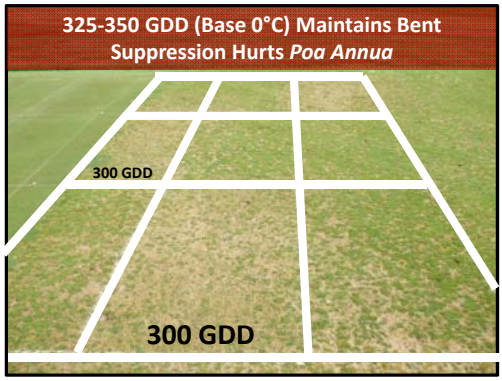
Suppression and rebound with 6 week paclobutrazol (Trimmit) applications



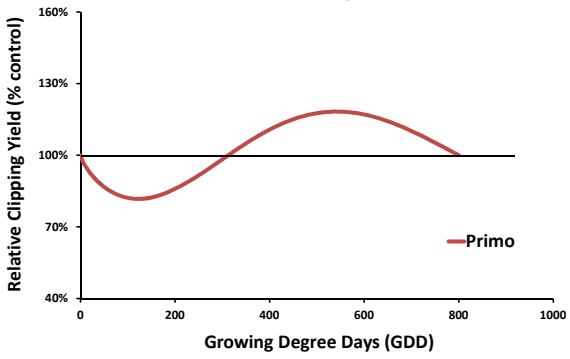
GDD accumulation predict paclobutrazol putting green performance



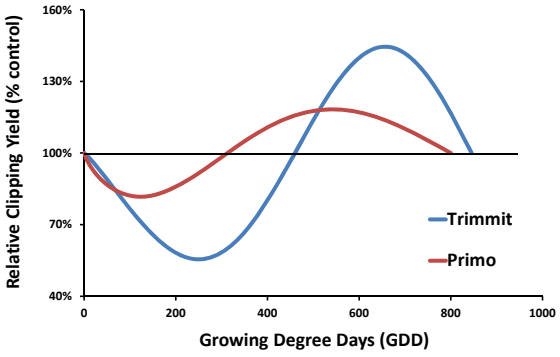
GDDs and Trimmit on Greens



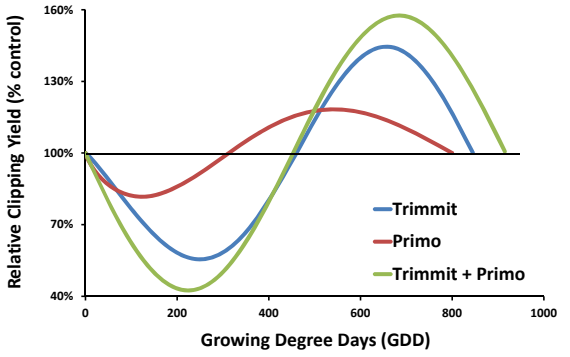
Comparing Plant Growth Regulator Performance on Bentgrass Greens



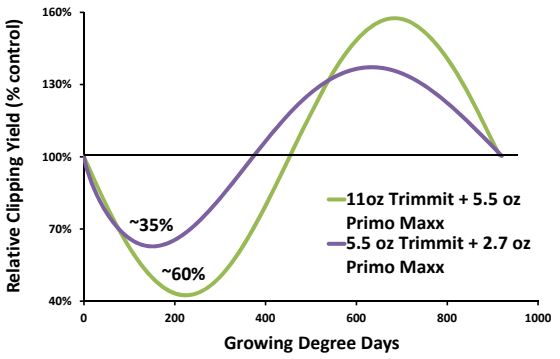
Comparing Plant Growth Regulator Performance on Bentgrass Greens



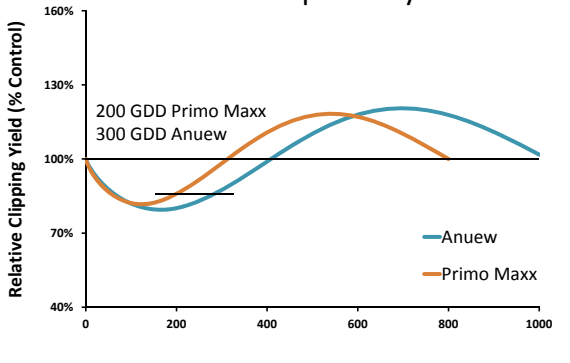
Comparing Plant Growth Regulator Performance on Bentgrass Greens



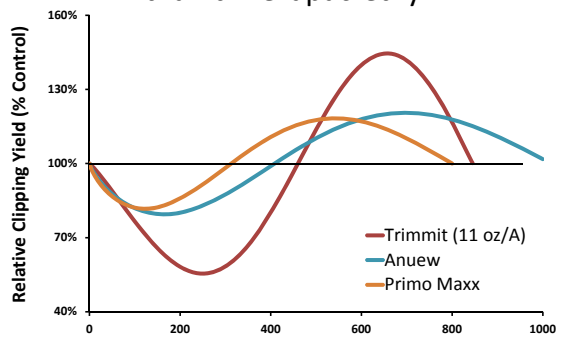
Likely Rate Response with Paclobutrazol



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

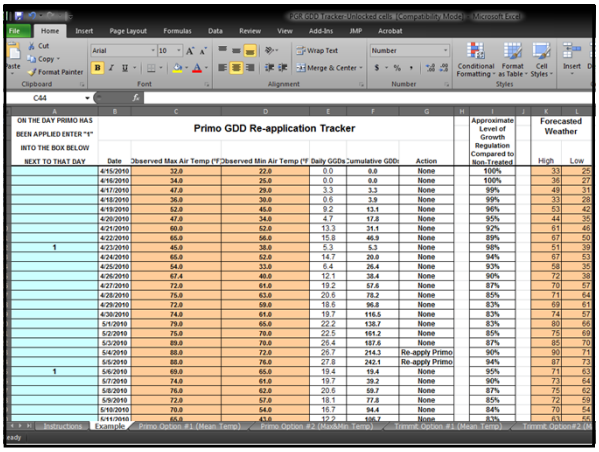


Prohexadione Ca (Anuew) lasts longer than trinexapac-ethyl



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



New GreenKeeper ™ App Arriving this Spring

Bill Kreuser
wkreuser2@unl.edu
http://turf.unl.edu/

Turfgrass Science
University of Nebraska