

# **Making Plant Growth Regulators Work For You**

**Tom Serensits  
Penn State University**



A wide-angle photograph of a golfer in a blue shirt and white pants mowing a green on a golf course. A sand trap is visible in the background.

**Increase Green Speed**

A close-up photograph of a white golf ball sitting on a green.

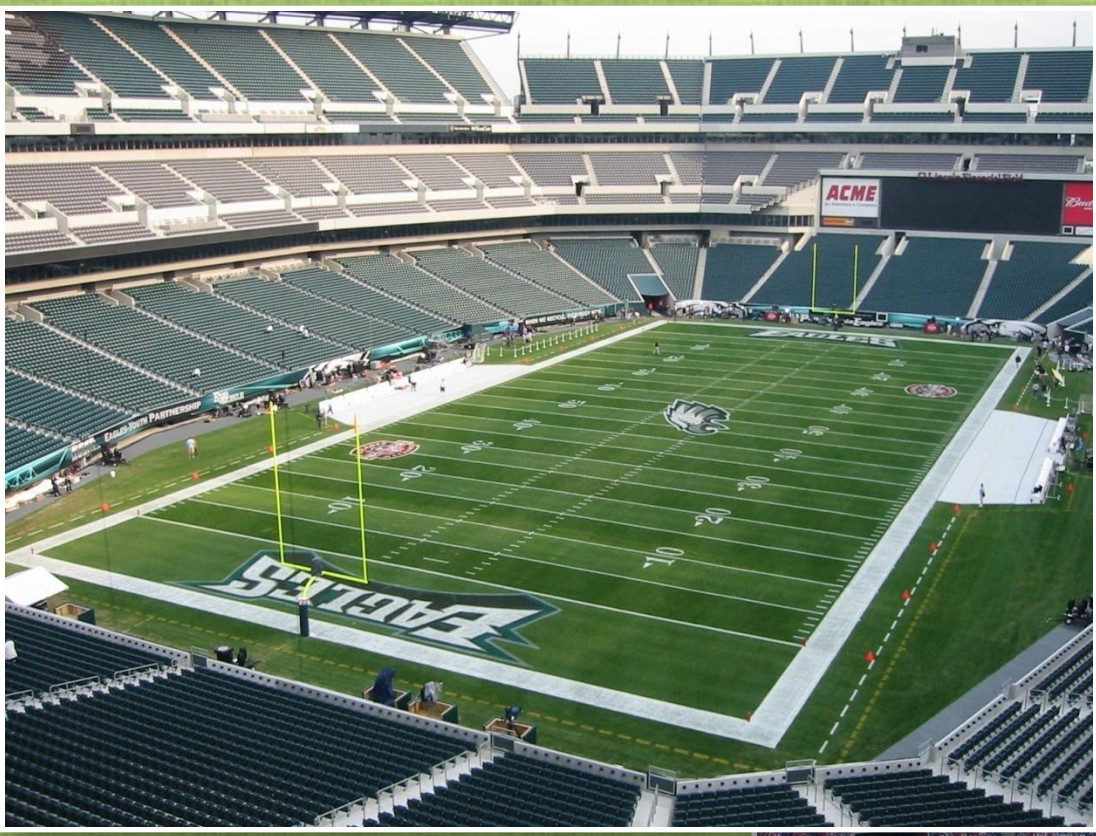
**Reduce *Poa annua* Seedheads**

A man in a grey polo shirt and blue jeans operating a red and black lawnmower on a golf course. The mower has a grey collection bag and the number 21 on it.

**Reduce Clippings**

A wide-angle photograph of a golf course green with a yellow and black checkered flag. A large crowd of people is visible in the background.

**Reduce *Poa annua* Population**



# How do PGRs Work?

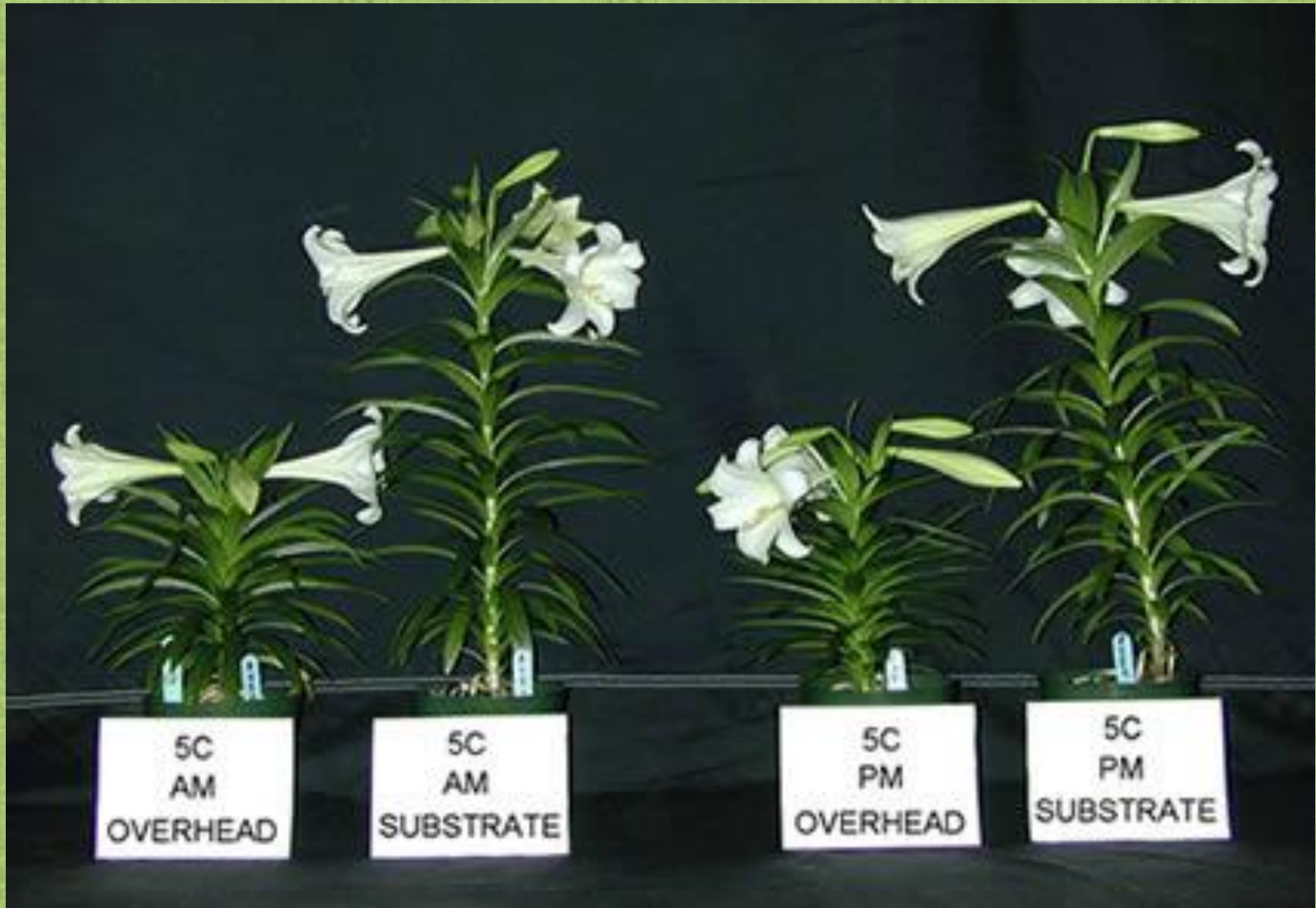
**Hormones !**



# How do PGRs Work?

**Hormones !**





5C  
AM  
OVERHEAD

5C  
AM  
SUBSTRATE

5C  
PM  
OVERHEAD

5C  
PM  
SUBSTRATE



# PGR - Definition

- **An organic compound, which when present or applied in small amounts, results in a change in turf growth or development**





# Plant Hormones

- **6 Classes of Plant Hormones**
  - **Auxin – Rooting**
  - **Abscisic Acid – Stomate Closing**
  - **Brassinosteroids – Shoot Growth**
  - **Ethylene – Fruit Ripening**
  - **Cytokinins – Cell Division**
  - **Gibberellins – Cell Elongation**

# Plant Hormones

## Growth Promoters

- Auxin
- Brassinosteroids
- Cytokinins
- Gibberellins

## Growth Inhibitors

- Abscisic Acid
- Ethylene

**So, do PGRs we use on turf contain additional growth inhibitors?**

# **Answer – No !**

- **Majority of PGRs –**
  - **Inhibit Growth Promoters (Gibberellins or Cytokinins)**
- **Proxy (Ethephon) – Enhances Release of Ethylene Gas – Seedhead Suppression**

# PGR Use in Turf

- **First Used in the 1950s**
- **Limited Use – Discoloration**
- **1970s – *Poa annua* Seedhead Suppression**



Courtesy [www.turffiles.ncsu.edu](http://www.turffiles.ncsu.edu)

# PGR Classification

- **Traditional Classification**

- **Type I**

- Foliar-Absorbed, Inhibit Cell Division (Cytokinins)
    - Seedhead Suppressors

- **Type II**

- Crown and Root-Absorbed, Inhibit Cell Elongation (Gibberellins)
    - Suppress Vertical Shoot Growth

# PGR Classification

- **New Classification System – 5 Classes**
  - **Class A** – Inhibit Gibberellins Late in Synthesis, Foliar-Absorbed (*Primo Maxx*)
  - **Class B** – Inhibit Gibberellins Early in Synthesis, Root-Absorbed (*Trimmit, Cutless*)

# PGR Classification

- Class C – Inhibit Cell Division, Foliar-Absorbed (*Embark*)
- Class D – Herbicides (*Roundup, Prograss*)
- Class E – Promote Ethylene Production, Foliar-Absorbed (Seedhead Suppression) (*Proxy*)
- Class F - Combinations

# Class A and B PGRs

- **Gibberellins – More than 130 Identified**
- **Functions of Gibbs**
  - Cell Elongation
  - Promote Flowering
  - Promote Seed Germ.
  - Promote Parthenocarpy (Seedlessness)








# Gibberellins in Turf

- ProGibb T & O
- Labeled for Bermudagrass (Maintain Growth During Cold Stress)
- Produces Rapid Vertical Growth

**ProGibb T&O**  
PLANT GROWTH REGULATOR (PGR) SOLUTION

   FOR ORGANIC PRODUCTION

For use on turf and ornamental crops.

ACTIVE INGREDIENT:

Gibberellic Acid .....	4.0% w/w
OTHER INGREDIENTS .....	96.0% w/w
TOTAL .....	100.0% w/w

ProGibb T&O liquid contains approximately 1.0 gram active ingredient per fluid ounce of formulated product.

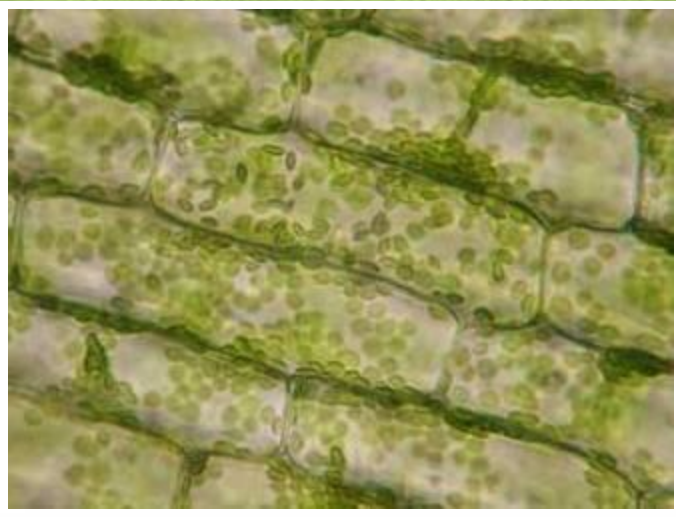
EPA Reg. No. 73049-15  
EPA Est. No. 33762-IA-001

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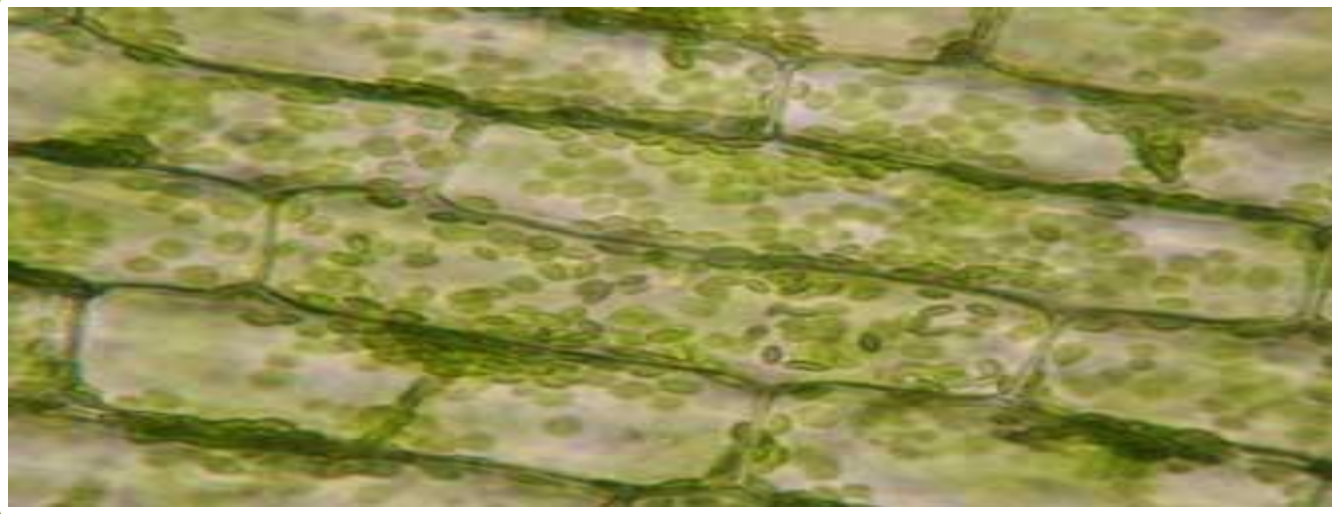
Gibberellins







**Normal Gibb.**



**Increased Gibb.**

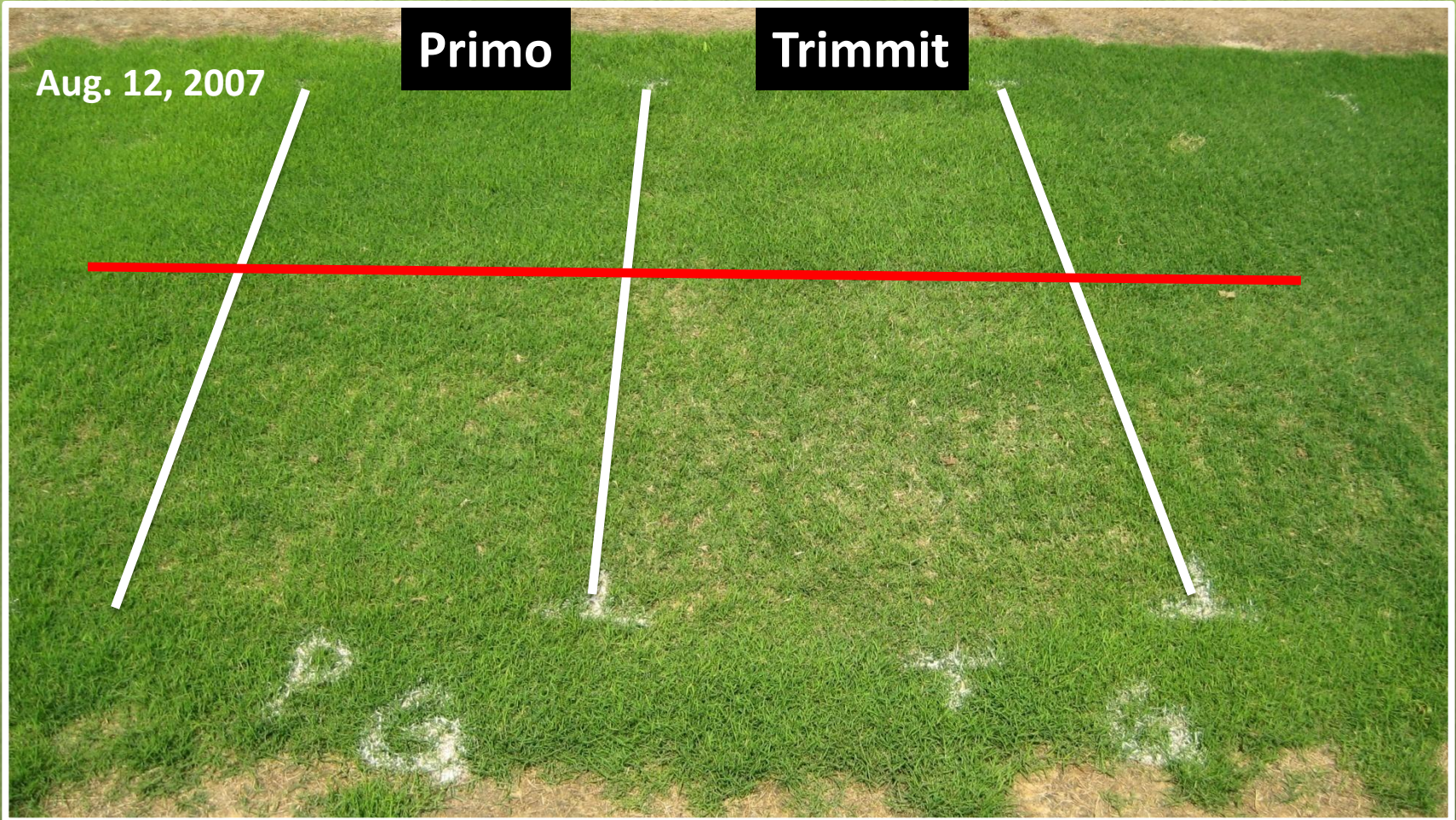
# Gibberellins on Bermudagrass



# Gibberellins on Bermudagrass



# Break Out of Growth Regulation

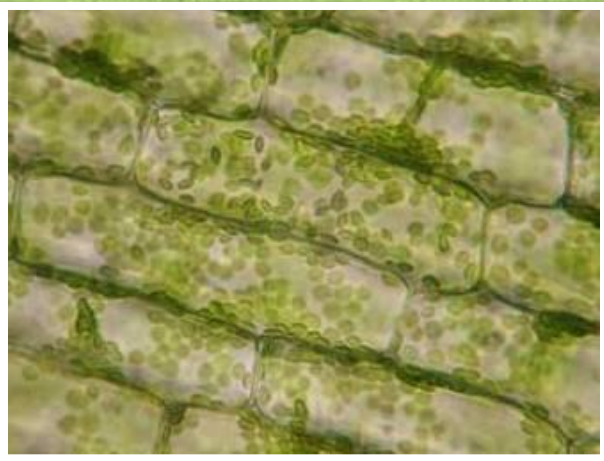


# Gibberellins in Turf

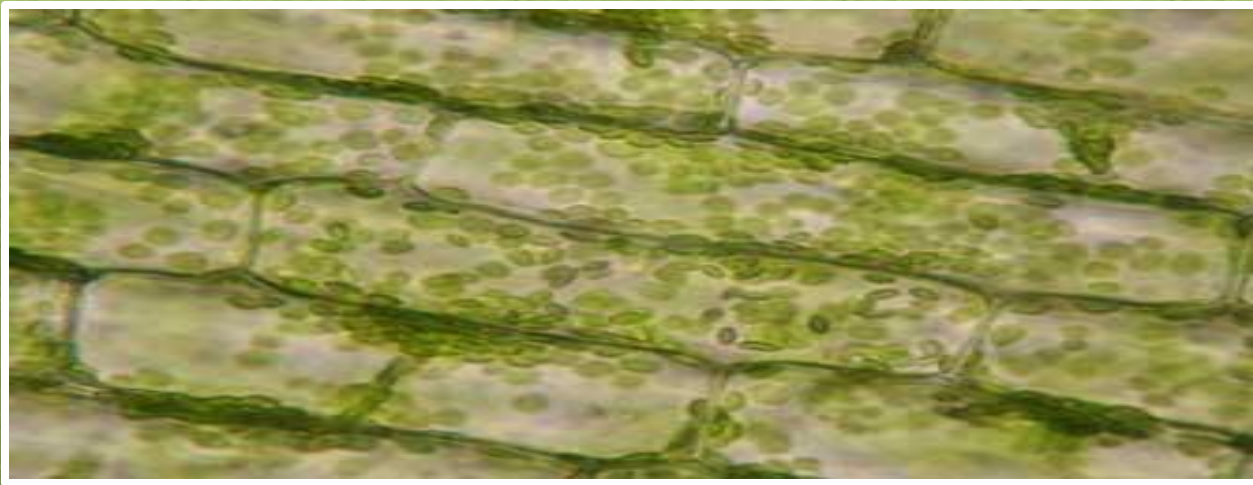
- **Class A and B PGRs Block the Biosynthesis of Gibberellins and Create Miniature Plants**



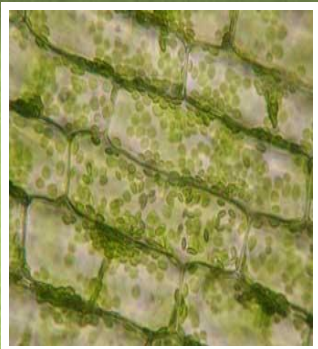




**Normal Gibb.**

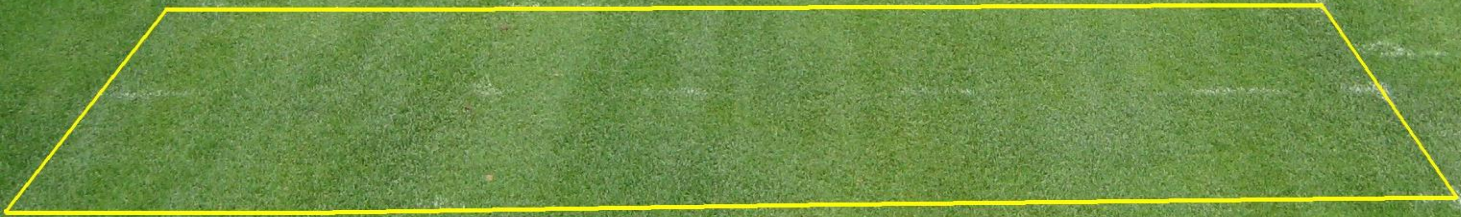


**Increased Gibb.**



**Reduced Gibb.**

**Darker Green Color**





**Untreated**

**Primo Maxx at 11 oz/A**


# Common Bermudagrass

- **Gibberellin Inhibiting PGR Applications May Cause Common Bermudagrass to Resemble Hybrid Bermudagrass**
  - **More Compact Leaf Canopy Because of Shortened Internodes**

# Class A PGRs

- **Primo Maxx**
  - Trinexapac-ethyl
- **50% Reduction in Clippings (28 Days)**
- **Increased Tiller Density**
- **Rooting??**

PULL HERE TO OPEN ►



**Primo  
MAXX™**

**For Turf Growth Management**  
*For managing growth, improving quality and stress tolerance,  
and edging of warm- and cool-season turfgrasses*


Active Ingredient: Trinexapac-ethyl (CAS No. 95266-40-3) .....	11.3%
Other Ingredients:	88.7%
Total:	100.0%

*Primo MAXX is a microemulsion concentrate.*

**KEEP OUT OF REACH OF CHILDREN.**  
**CAUTION**  
*See additional precautionary statements and directions for use inside  
booklet.*

EPA Reg. No. 100-937  
EPA Est. 62171-MS-001  
Product of Switzerland  
Formulated in the USA  
SCP 937A-L1E 0605

**1 gallon**  
U.S. Standard Measure



syngenta

# Class A PGRs

- **Governor**
  - Trinexapac-ethyl
- **Granular**
- **Apply to Damp Turf**
- **Similar Results to Primo Maxx**

## ***Governor***<sup>TM</sup> **Growth Regulator**

For Turf Growth Management

- Contains same active ingredient as Primo®
- Unique granular formulation for spreader application.
- Ideal for hard to reach mowing areas.
- Reduces turf grass clippings by up to 50%.

**ACTIVE INGREDIENT:**

Trinexapac-ethyl (CAS No. 95266-40-3) ..... 0.17%

**OTHER INGREDIENTS:** ..... 99.83%

Total ..... 100.00%

EPA Reg. No. 100-930-9198

EPA Est. No. 9198-OH-1M, 9198-OH-2B, 9198-AL-001A

Underlined letter is first letter used in run code on bag.

Primo® is a trademark of a Syngenta Group Company

Governor™ is a trademark of The Andersons Agriservices, Inc.



# Class B PGRs

- **Trimmit, TGR**
  - Paclobutrazol (Granular and Liquid)
- **Root-Absorbed – Water In**
- **Reduced Growth – 6 to 8 Weeks**
- ***Poa annua* control**

**Andersons**  
GOLF PRODUCTS

## 22-4-10

with TGR® *Poa annua* Control

- Suppresses *Poa annua* growth in bentgrass, zoysiagrass, Kentucky bluegrass, perennial ryegrass and Kentucky bluegrass/perennial ryegrass fairways, tees and roughs
- Encourages preferential and aggressive growth of bentgrass, zoysiagrass, Kentucky bluegrass, and perennial ryegrass into adjacent *Poa annua* areas

ACTIVE INGREDIENT:		
Paclobutrazol	0.25%	
OTHER INGREDIENTS:	99.75%	
	Total	100.00%

EPA Reg. No. 9766-21-5  
EPA Est. Nos. 9190-CH-1, 9190-CH-2, 9190-AL-001A  
Underlined letter is first letter used in run code on bag.

US Patent Nos. 3,765,794 and 3,989,470

**KEEP OUT OF REACH OF CHILDREN  
CAUTION**

**Trimmit 2SC**

**Plant Growth Regulator  
For Turfgrass**

Active Ingredient:

Paclobutrazol	22.3%
(S)-[R]-beta-[[4-(chlorophenyl)methyl]-alpha-(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol]	77.7%
Other Ingredients:	100.0%

Contains 2 lbs. active ingredient per gallon.

**KEEP OUT OF REACH OF CHILDREN.  
CAUTION**

See additional precautionary statements and directions for use inside booklet.

EPA Reg. No. 100-1014  
EPA Est. 5905-JA-01  
Product of the United Kingdom  
Formulated in the USA  
SCP 1014B-L2A 1006  
243909

**1 gallon**  
Net Contents

**syngenta**



# Class B PGRs

- **Cutless**
  - Flurprimidol
- **Granular Formulation**
  - Landscape –  
Ornamentals
  - Less Trimming
  - Darker Green

## Specimen Label

# Cutless\* 50W

Turf Growth Regulator



For Growth Management and Quality Improvement of Perennial Cool and Warm Season Turfgrasses.

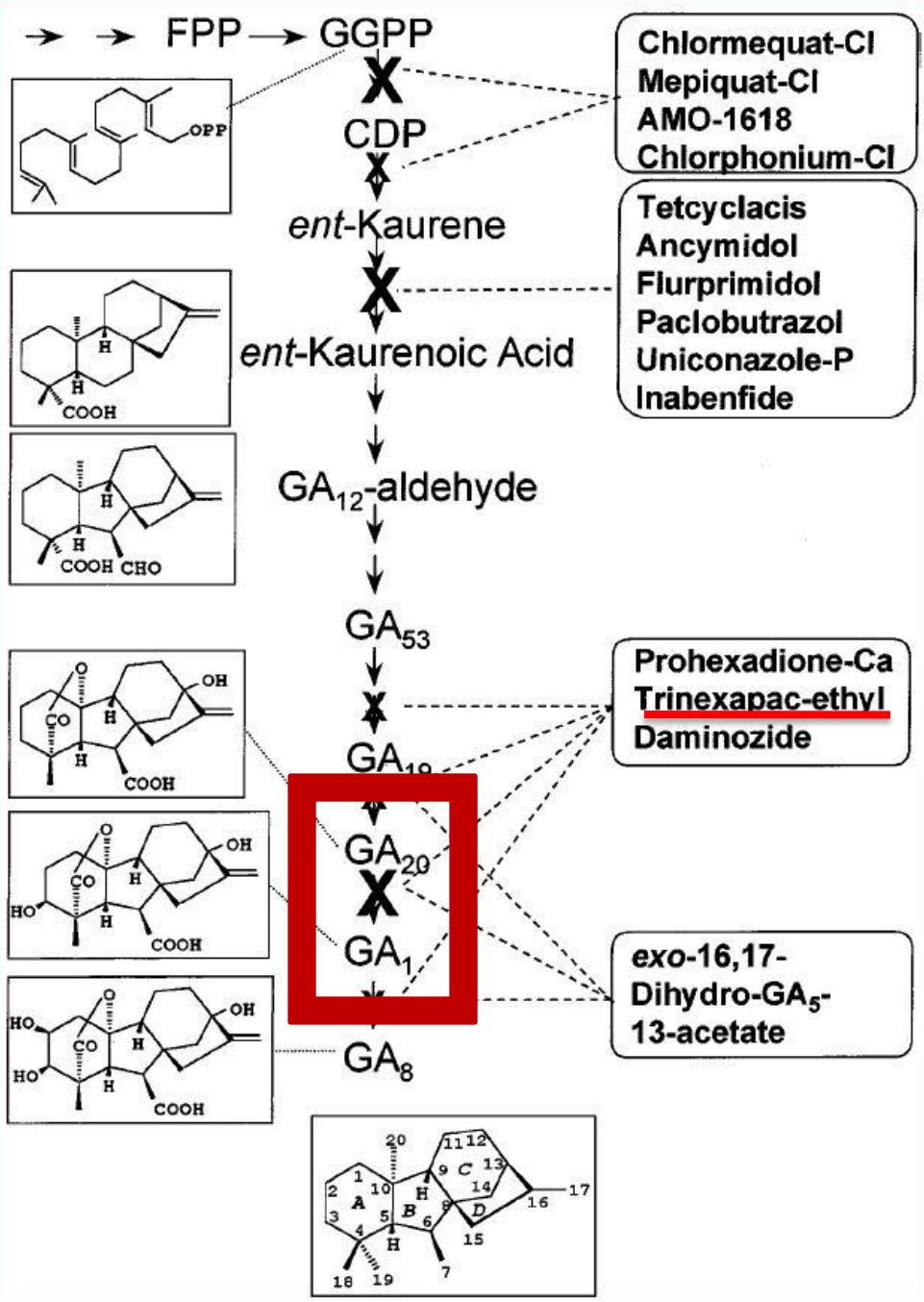
### Active Ingredient

flurprimidol: $\alpha$ -(1-methylethyl)- $\alpha$ -[4-(trifluoromethoxy)phenyl]-5-pyrimidinemethanol.....	50%
Other Ingredients .....	50%
TOTAL.....	100%

Contains 0.50 pound of active ingredient per pound of formulated product.

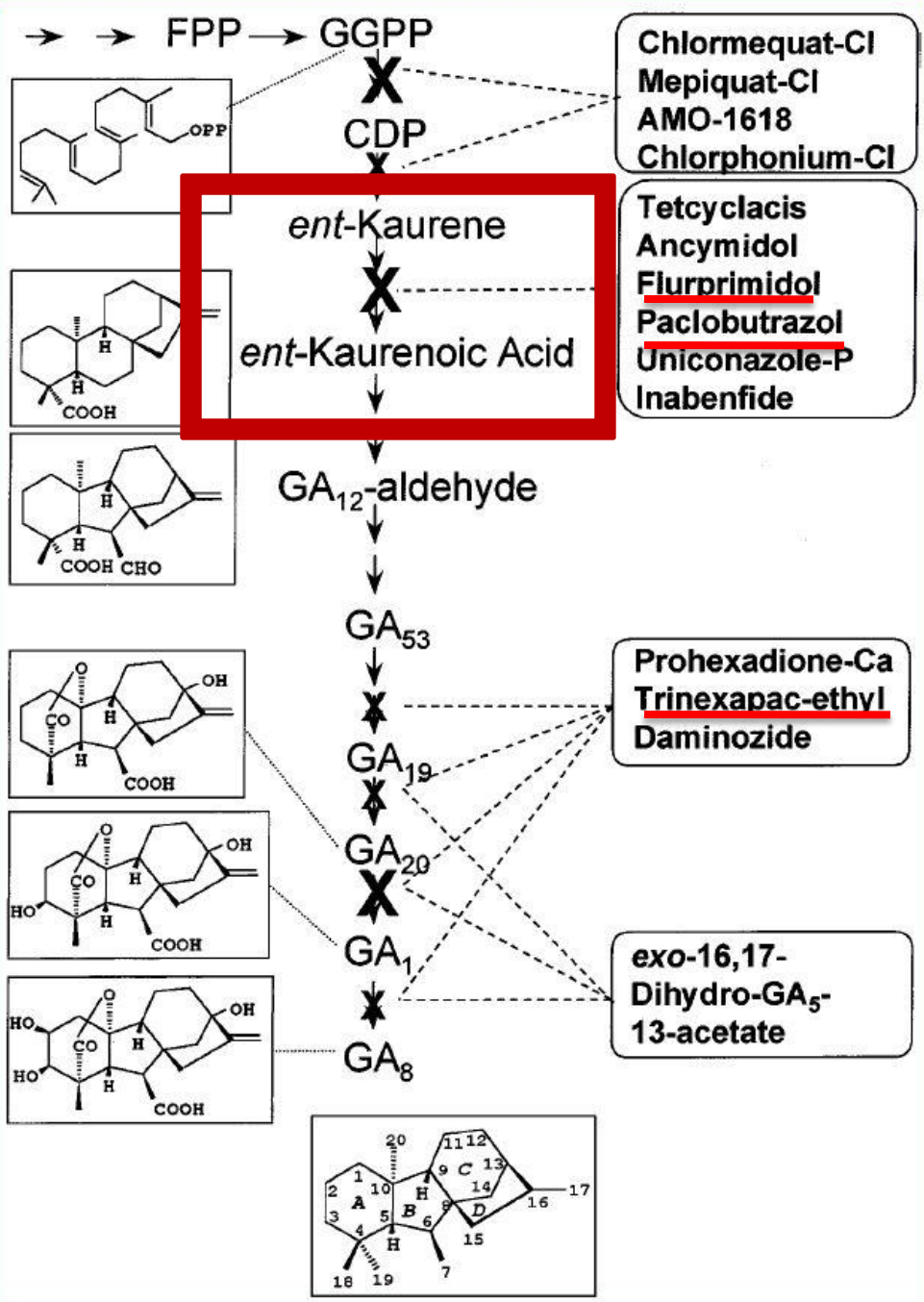
# Class A vs Class B

- **Class A – Primo Maxx**
- **2 Gibberellins are Involved**
  - **GA<sub>1</sub>** – Responsible for Shoot Elongation
  - **GA<sub>20</sub>** – Produces GA1
- **Enzyme that Converts GA<sub>20</sub> to GA<sub>1</sub> is Inhibited**
  - **GA<sub>20</sub>-3-β-hydroxylase**



# Class A vs Class B

- **Class B – Trimit**
- **Blocks the Formation of Ent-Kaurenoic Acid**
  - Precursor to Active Gibberellins
- **Target Enzyme**
  - cytochrome P450 monooxygenase



# Class C PGR

- Embark T & O
  - Mefluidide
- Slows Cell Division (Cytokinins)
- Seedhead Suppression
- Turf Injury



**EMBARK<sup>®</sup>**  
Turf and Ornamental Growth Regulator

**ACTIVE INGREDIENT:**  
Diethanolamine salt of mefluidide (N-[2,4-dimethyl-5-  
[[trifluoromethyl]-sulfonyl]amino]phenyl]acetamide) ..... 3.2%

**INERT INGREDIENTS:** ..... 96.8%


TOTAL 100.0%

Equivalent to 0.2 lbs. (2.4% by weight) (N-[2,4-dimethyl-5-[[trifluoromethyl]-sulfonyl] amino]phenyl]acetamide) per gallon.  
U.S. Patent Nos. 3,639,474; 3,894,078; 4,013,444.

**KEEP OUT OF REACH OF CHILDREN**  
**CAUTION**

# Class E PGR

- Proxy
  - Ethephon
- Enhances Release of Ethylene Gas
- Foliar Absorbed
- Seedhead Suppression



**PROXY**<sup>®</sup>

**GROWTH REGULATOR**

*\* For Commercial Use on Turf including Golf, Parks, and Sports Turf.  
\* Not For Residential Use.*

**ACTIVE INGREDIENT:**  
Ethephon [(2-chloroethyl)phosphonic acid]\* ..... 21.7%\*

**OTHER INGREDIENTS** ..... 78.3%\*\*

TOTAL ..... 100.0%

**KEEP OUT OF REACH OF CHILDREN**

**DANGER PELIGRO**

# Combination – Class F

- **Legacy**
  - Flurprimidol and Trinexapac-ethyl
- **Foliar and Root Uptake**
- **Less Rebound Effect**
- **No Water for 2 Hours; Water Within 24 Hours**

**Specimen Label**

**Legacy\***  
Turf Growth Regulator



For Growth Management and Quality Improvement of Perennial Cool- and Warm-Season Turfgrasses on Golf Courses.

**Active Ingredient**

flurprimidol: $\alpha$ -(1-methylethyl)- $\alpha$ -[4-(trifluoromethoxy)phenyl]-5-pyrimidinemethanol.....	13.26%
trinexapac-ethyl: 4-(cyclopropyl-alpha-hydroxymethylene)-3,5-dioxo-cyclohexanecarboxylic acid ethyl ester.....	5.00%
Other Ingredients .....	81.74%
<b>TOTAL</b> .....	<b>100.00%</b>



# PGRs on Athletic Fields

- **Gibberellin Inhibiting PGRs**

- **Primo**

- **Trimmit**

- **Cutless**

- **TGR**



# Surface Stability

Divoting = complete shearing (removal) of turf root system from rootzone



# Primo

- **Increased Rooting?**
- **Increased Tillering?**



# Does Primo Reduce Divot Size?



# Research Trial

- **Kentucky Bluegrass**

- **2 Rootzones**

- **USGA Sand**

- **Silt Loam Soil**



- **Evaluated Divot Resistance, Tiller Density, and Root Mass**

# Primo Applications

- **Rate: 0.5 oz/1000ft<sup>2</sup>**
- **28-Day Intervals**
- **2 Application Regimes:**
  - **May – July (3 Applications)**
  - **May – October (6 Applications)**



# Simulated Football Season



# Simulated Football Season

No Wear    Medium Wear    High Wear





# Divot Resistance Evaluation





# Results

- **Primo Applied From May – July Reduced Divot Size Most**
  - Sand: 10 – 20% Reduction
  - Soil: 10% Reduction
- **Primo Applied From May – October was not better/worse than Untreated Plots**

# Results

- **Tiller Density**
  - **Primo Treatments Increased Tiller Density up to 15%**
  
- **Root Mass**
  - **Primo Applied May – July Increased Root Mass by 10%**

# How Does Primo Increase Tillering / Rooting?

- Hybrid Bermuda – 50% more N was Allocated to Roots / Rhizomes when Treated with Primo (Fagerness et al., 2004)



# How are New Roots and Tillers Formed?

- **Cell Division**
  - Cytokinins
- **Does Primo Affect Cytokinins in Plants?**



# Primo and Cytokinins

- **Ervin and Zhang (2007)**
  - **Found an Increase in Cytokinin Levels Following Sequential Applications of Primo**
  - **Do Not Know How Decreasing Gibberellin Levels (from Primo) Increase Cytokinin Levels**

# Primo Effects

- **A Shift of Plant Carbohydrates to Crowns, Stems, and Roots May Increase Rooting and Tillering**





# Conclusions From Trial

- **Primo Applied in Spring and Summer Improves Divot Resistance for Fields Used in the Fall**
  - Increase in Tiller Number
  - Increase in Root Mass



# Conclusions From Trial

- **Primo Applications Continued During the Season Did Not Improve Divot Resistance**
  - **May Negatively Affect Recovery from Wear**



# K. Bluegrass Cultivars

- **Primo had biggest effect on least divot resistant cultivars**
- **Most divot resistant: Limousine, Rugby II, P105, Julia**
- **Least divot resistant: Baron and Midnight**

# K. Bluegrass Cultivars & Primo

- **Primo made least divot resistant cultivars perform like most divot resistant cultivars (untreated)**



# What About Bermudagrass?

- **University of Tennessee Research – William Haselbauer**
  - **Primo**
  - **Similar treatments to Penn State study (also overseeding)**
  - **Tifway, Celebration, Riviera, Patriot**



# Bermudagrass and Primo

- **“Pre-Stress Conditioning” Primo treatment improved traffic tolerance**
- **Continuing Primo apps through season decreased traffic tolerance**
- **Overseeding combined with “Pre-Stress Conditioning” Primo treatment was best**

# Bermudagrass Cultivars

- **Tifway and Celebration were best**
- **Riviera performed well**
- **Patriot – least traffic tolerance**



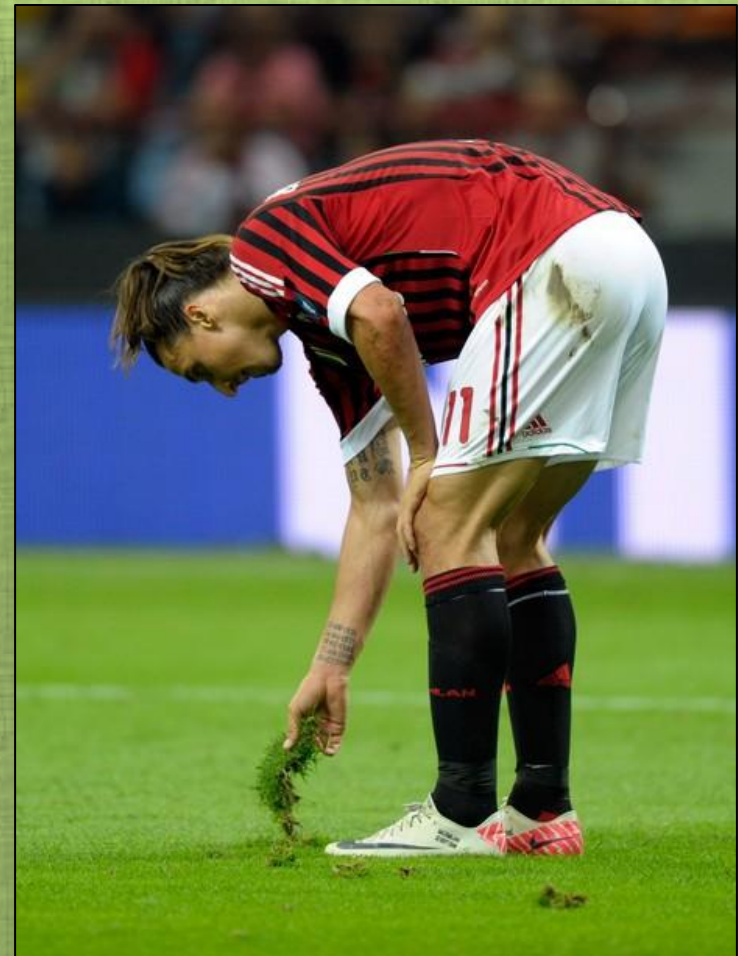
# Other PGRs on Bermudagrass

- **University of Tennessee – Dr. Jim Brosnan**
- **Ethephon (Proxy)**
- **Trinexapac-ethyl (Primo)**
- **Paclobutrazol (Trimmit)**
- **Flurprimidol (Cutless)**
- **Flurprimidol + Trinexapac-ethyl**
- **Ethephon + Trinexapac-ethyl**



# Other PGRs on Bermudagrass

- **Riviera bermudagrass**
- **“Pre-Stress Conditioning” Primo treatment**
- **Primo and combinations with Primo improved traffic tolerance**



# Conclusions From Trials

- **PGR: Primo**
- **When to apply: Before traffic stress**
- **When to avoid:**
  - **Fields used heavily throughout the year**
  - **During the season**
  - **Spring recovery?**

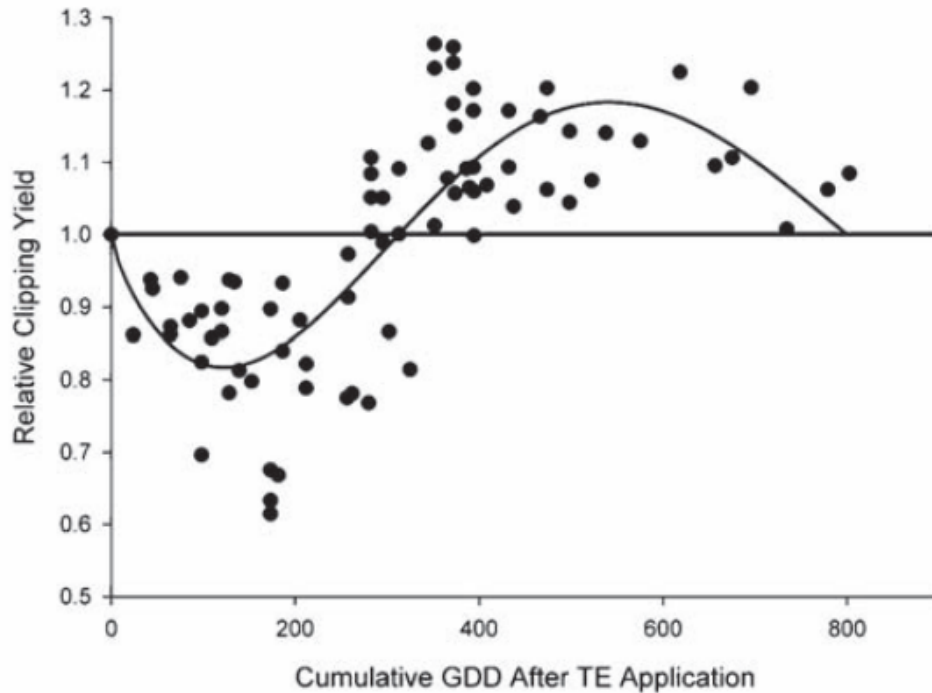
# Application Intervals

- **When do I re-apply?**
- **Duration of growth regulation dependent on temperature**
- **Calendar based system may not be best**



# PGR Rebound

- Growth rates up to **160% of normal rate**



# When Will Rebound Happen?

- **Trinexapac-ethyl metabolism directly related to air temperature** (Beasley and Branham, 2005)
  - 6.4 day half life at 64° F (18° C)
  - 3.2 day half life at 86° F (30° C)
- **Breakdown faster at higher temps – can it be predicted?**

# Growing Degree Day Model

- **University of Wisconsin  
– Bill Kreuser (Cornell)**
- **Daily high and low  
temps (base of 0° C)**
- **Goal: Avoid rebound by  
applying at proper  
intervals**

## University of Wisconsin-Madison Turfgrass Science



### Plant Growth Regulator Re-application Intervals

When a plant growth regulator is applied, it blocks hormone synthesis. The normal hormone synthesis will resume after the growth regulator is metabolized, or broken down, by the plant. The speed of growth regulator metabolism is strongly influenced by temperature. Therefore, the calendar based re-application interval is only a crude approximation of how long the growth regulator will work. It may work for only one week in the summer, or six weeks in the fall depending on temperature.

Based on five years of research, we've developed a growing degree day for accurately determining the proper re-application interval for trinexapac-ethyl and paclobutrazol for creeping bentgrass putting greens. Different plant metabolize growth regulators at different rates, so these models are only valid for creeping bentgrass.

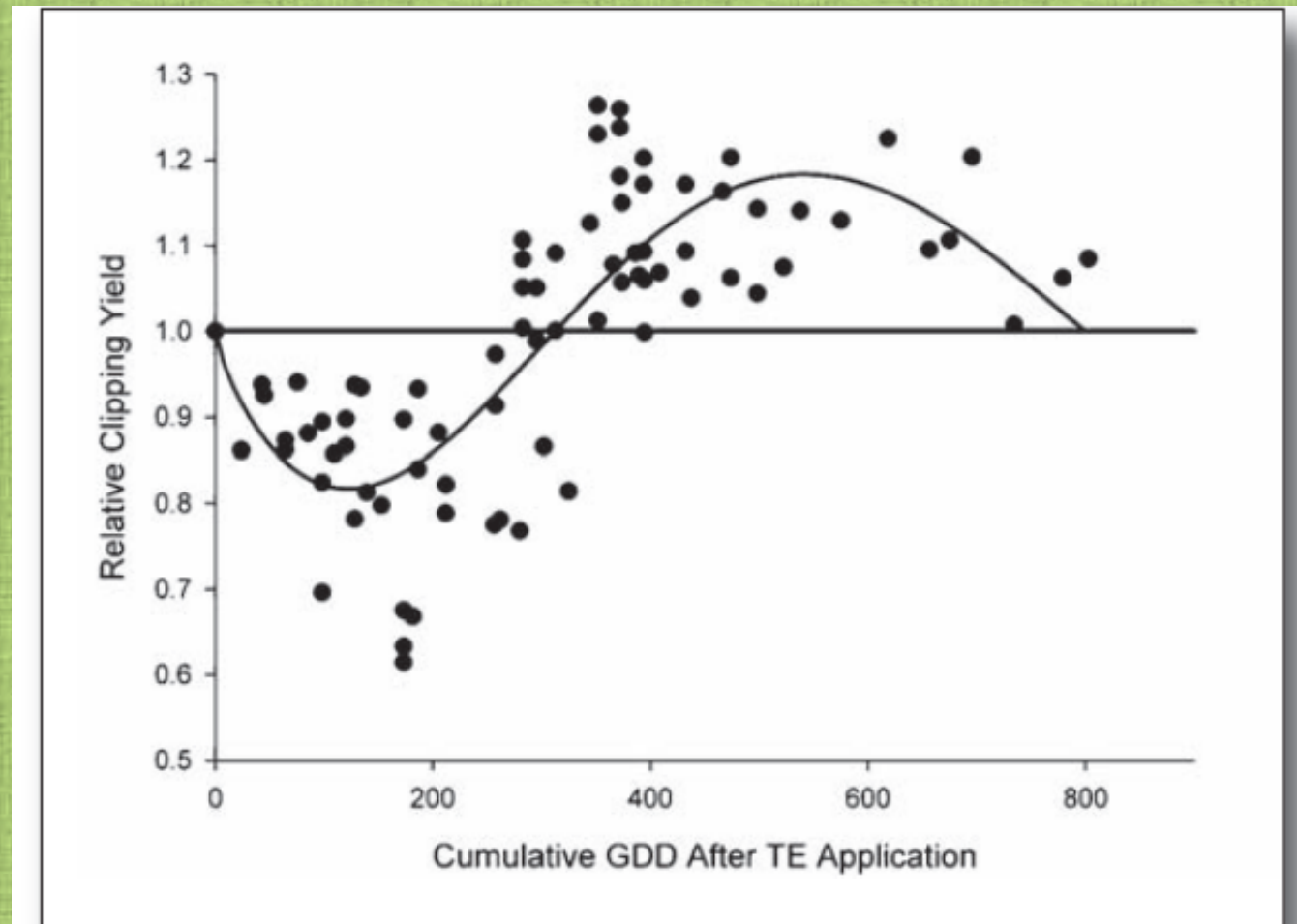
[Download the scheduling spreadsheet here](#)

Additional info regarding the growing degree day models for plant growth regulators:

# Growing Degree Day Model

- **Primo rate: 0.125 oz / 1000 ft<sup>2</sup>**
- **Research Findings** (creeping bent green):
  - **Suppression first 200 GD (rebound if longer)**
  - **May (avg temp 57) = 14 days**
  - **July (avg temp 72) = 9 days**

# Primo Rebound Effect





# Growing Degree Days Calculators

## iTunes Preview

[What's New](#)[What is iTunes](#)[What's on iTunes](#)[iTunes Charts](#)[How](#)

### Growing Degree Days

[View More By This Developer](#)

By iNet Solutions Group

Open iTunes to buy and download apps.

[View in iTunes](#)

**Free**

Category: [Weather](#)

Updated: Apr 05, 2011

Version: 4.0

Size: 4.5 MB

Language: English

Seller: iNet Solutions Group, Inc

© iNet Solutions Group, Inc.

Rated 4+

**Requirements:** Compatible with iPhone, iPod touch, and iPad. Requires iOS 3.1 or later

#### Customer Ratings

Current Version:

#### Description

The Farm Progress Growing Degree Days application measures the maturity of your crop by viewing current and past growing degree days data for your farm's location. Growing degree days (GDD) are a measure of heat accumulation used in agriculture to predict the date that crops will reach maturity.

[iNet Solutions Group Web Site](#) [Growing Degree Days Support](#)

[...More](#)

#### What's New in Version 4.0

Growing Degree Days can now be viewed either in Map or Text mode.

More detailed weather information added including: current conditions, animated radar, hourly forecast, extended

[...More](#)

#### iPhone Screenshots





# Example - Spring

## Primo GDD Re-application Tracker

	Observed Max Air Temp (°F)	Observed Min Air Temp (°F)	Daily GDDs	Cumulative GDDs	Action
4	60.0	45.0	11.4	0.0	None
5	57.0	48.0	11.4	11.4	None
6	62.0	48.0	12.8	24.2	None
7	62.0	49.0	13.1	37.2	None
8	59.0	50.0	12.5	49.7	None
9	60.0	48.0	12.2	61.9	None
10	62.0	50.0	13.3	75.3	None
11	62.0	52.0	13.9	89.2	None
12	60.0	52.0	13.3	102.5	None
13	63.0	52.0	14.2	116.7	None
14	60.0	50.0	10.0	126.7	None

# Example - Summer

	C	D	E	F	G	H
1	<b>Primo GDD Re-application Tracker</b>					
2						
3	<b>Observed Max Air Temp (°F)</b>	<b>Observed Min Air Temp (°F)</b>	<b>Daily GDDs</b>	<b>Cumulative GDDs</b>	<b>Action</b>	
4	88.0	65.0	24.7	0.0	None	
5	91.0	63.0	25.0	25.0	None	
6	86.0	68.0	25.0	50.0	None	
7	81.0	62.0	21.9	71.9	None	
8	89.0	70.0	26.4	98.3	None	
9	90.0	65.0	25.3	123.6	None	
10	92.0	65.0	25.8	149.4	None	
11	88.0	66.0	25.0	174.4	None	
12	84.0	68.0	24.4	198.9	None	
13	82.0	70.0	24.4	223.3	Re-apply Primo	
14	80.0	68.0	22.8	246.1	Re-apply Primo	

# Growing Degree Day Model

- **Rate vs. Application interval**
  - 0.125 fl oz and 0.25 fl oz
  - 0.25 fl oz did not increase level or duration of yield suppression (0.25 rate- higher visual quality)
- **Designed for putting greens**
- **Paclobutrazol – 300 GDD (bent)**

# Growing Degree Day Model

- **Suppression phase – air temp not calendar**
- **Re-apply Primo every 200 GDD on creeping bentgrass greens**
- **Rates greater than 0.125 fl oz / 1000 ft<sup>2</sup> do not increase suppression**

# Cost Analysis – 2 Mowings/Week to 1 Mowing/Week

	No Primo	Primo – 3 Apps (May-July)
Primo <sup>1</sup> (\$90/Field/App)	\$0	\$270
Primo Application <sup>2</sup> (\$40/Field/App)	\$0	\$120
Mowing <sup>3</sup>	\$960	\$480
<b>Total</b>	<b>\$960</b>	<b>\$870</b>

<sup>1</sup> Primo Cost Based on \$400/gallon at rate of 0.5 oz/1000ft<sup>2</sup> (28.8oz/field)

<sup>2</sup> Application Cost includes labor, fuel, maintenance

<sup>3</sup> Mowing Cost includes labor, fuel, maintenance for 12 weeks of mowing (May 31 – Aug 30) and is based on 2 mowings/week for non Primo and 1 mowing/week for Primo (2002)

# Applying Primo

- **Foliar Absorbed**
  - Must Dry on Leaf (Label Says 1 Hour)
- **Expect 50% Growth Reduction (Effects 3-5 Days After Application)**
- **May Have Some Discoloration After First Application**
  - Then Darker Green Color



# Applying PGRs

**Do Not Apply to Stressed Turf**



# Applying PGRs

- **Do Not Apply Immediately Before or After Cultural Practices**

**(Aerification,  
Verticutting, etc.)**



# Applying PGRs

- **May Enhance Fungicide Activity (Primo)**
- **Longer Recuperation Time From Damage**



# Applying PGRs

- **Be Ready for Post-Suppression Growth Surge (Rebound Effect)**
- **Use it to Your Advantage**



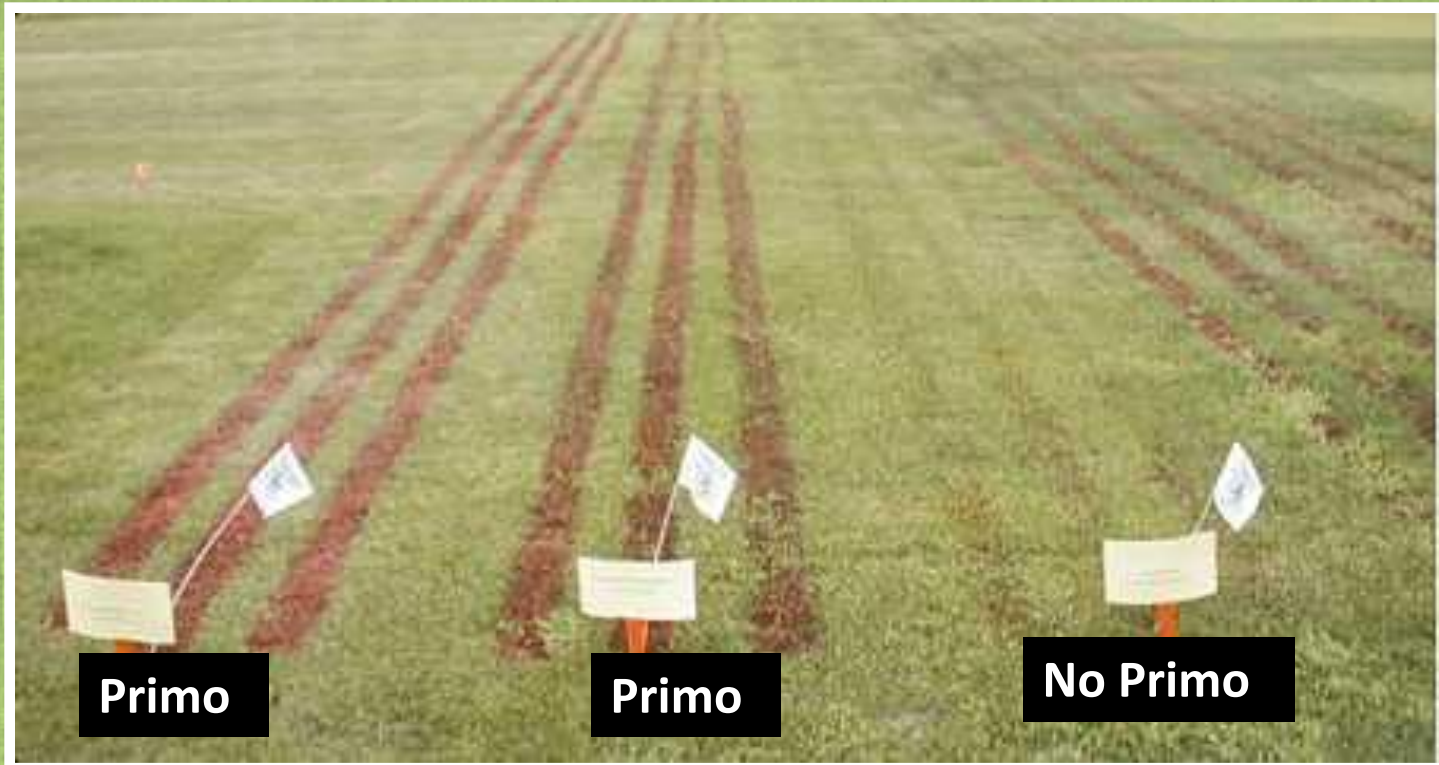
# Other Uses

## Primo in Turf Marking Paint



# Primo in Paint

- **Primo Label: 1 oz/Gallon on Paint (Monthly)**









# Primo in Paint



# Other Uses For Primo

- Preparation for Non-Sports Events



# Non-Sports Events

- Graduations



# Non-Sports Events

- **Recommendations:**
  - **Primo Application at Least 2 Months Before Event**
  - **Primo Application 21 Days Before Field is to be Uncovered**
  - **Growth Surge – grow out of damage**

Recommendations by Steve LeGros (Sports Field Mgmt, Nov. 2007)

# *Poa annua* Control?



# Poa annua Control?

- **Trimmit (Paclobutrazol)**
  - Root-Absorbed – Water in
  - Include Some N to Mask Discoloration
  - Slows Growth 6 - 8 Weeks

PULL HERE TO OPEN ►



**Trimmit<sup>®</sup> 2SC**

**Plant Growth Regulator  
For Turfgrass**

Active Ingredient:  
Paclobutrazol  
(±)-(R\*,R\*)-beta-[(4-chlorophenyl)methyl]-alpha-(1,1-dimethylethyl)-1H-1,2,4-triazole-1-ethanol . . . . . 22.3%

Other Ingredients: . . . . . 77.7%

Total: . . . . . 100.0%

Contains 2 lbs. active ingredient per gallon.

**KEEP OUT OF REACH OF CHILDREN.  
CAUTION**

See additional precautionary statements and directions for use inside booklet.

EPA Reg. No. 100-1014  
EPA Est. 5905-IA-01  
Product of the United Kingdom  
Formulated in the USA  
SCP 1014B-L2A 1006  
243909

**1 gallon**  
Net Contents



# *Poa annua* Control?

- **Reduces Population Over Time**
- **Discoloration**



# ***Poa annua* Control?**

- **Be Careful!**
  - Know How Much *Poa* You Have
  - Can Discoloration Be Tolerated?
  - Can You Establish Turf in its Place?
- **During Play – Actively Growing *Poa* is Better than Injured *Poa***
- **Seed Desirable Species (Perennial Ryegrass)**



# ***Poa annua* Control?**

- **Football Fields: Apply in Spring**
- **Baseball Fields: Apply in Fall**
- **Do Not Apply During Hot Weather**
- **Label: Do Not Seed Within 6 Weeks Prior or 2 Weeks After Application**

# **PGRs on Athletic Fields**

- **Do Not Apply on Heavily Used Fields**
- **Primo – “Preconditioning” - Use During Spring and Summer and then Stop Applications Before Season**
  - **Increase Tillering**
  - **Increase Rooting**

# PGRs on Athletic Fields

- **Primo in Paint**
- **Apply Before Non-Sports Events**
- ***Poa annua* Control?**
- **Be Sure to Read Label**

# **Penn State's Center for Sports Surface Research**

**Website: <http://ssrc.psu.edu>**



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