

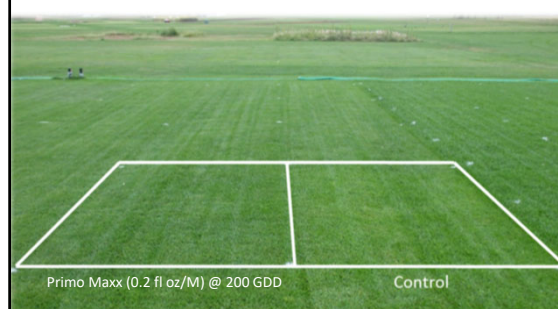
Do PGRs Have a Place in Lawn and Sports Turf?

Bill Kreuser



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PGRs Increase Density, Color, Quality



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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)

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Some of the reasons we use PGRs

- Growth Suppression
- Improved Color, Quality, Density
- Increased Sugar Reserves
- Increased Rooting
- Increased Green Speed
- Improved Stress Tolerance
- Reduced Nutrient Requirements
- Annual Bluegrass Control
- Seedhead Suppression

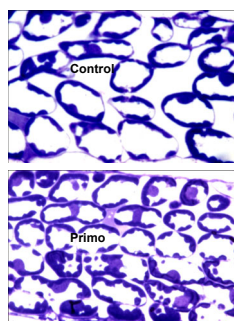
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TE increases cell density and chlorophyll

Table 1: Effects of trinexapac-ethyl (TE) (0.27 kg·ha⁻¹ (a.i.) on mesophyll cells and chlorophyll concentration of Kentucky bluegrass.

Observation	Control	Treated	P	CV (%)
<i>Mesophyll cells (4 wk)</i>				
No./mm ²	550	750	0.003	22.4
Length (µm)	36	45	0.001	13.5
Width (µm)	32	30	0.160	11.7
<i>Chlorophyll content (mg·g⁻¹ FW)</i>				
2 WAT - a	2.71	2.94	0.170	13.0
b	1.31	1.60	0.001	11.3
Total	4.02	4.55	0.004	8.4
4 WAT - a	2.76	2.65	0.010	3.3
b	0.62	1.10	0.033	53.3
Total	3.39	3.74	0.110	13.3

Ervin and Koski. 1998. HortSci. 33(7):1200-1202.



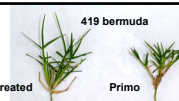
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Primo increases Tiller Density

Ervin, HortSci. 1998; Crop Sci. 2001; HortSci. 2001

Species	Tillers per 4 inch plug	
	Primo	No Primo
Perennial ryegrass	341	203
Kentucky bluegrass	266	233
Zoysia	338	301

Class B's also increase tiller density of C3 & C4 turfgrasses



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PGRs Reduced Traffic Tolerance

- High levels of relative growth suppression
- PGRs limited regrowth of leaves vertically
- Traffic damage lingered
- How can/should PGRs be used

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Classification of *all* PGRs

Common Examples

- **Class A:** Late Gibberellic Acid Inhibitors (Type II) Trinexapac-ethyl
- **Class B:** Early Gibberellic Acid Inhibitors (Type I) Paclobutrazol
- **Class C:** Cell Division Inhibitors Mefluidide
- **Class D:** Herbicides Glyphosate
- **Class E:** Plant Hormones/Mimics Ethephon
- **Class F:** Naturally Occurring PGRs Humic Acids

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Class A Compounds

- Late Inhibition of Gibberellic Acid
 - Final Step in Pathway
- Foliar Absorption
 - Rapid Uptake (15 to 60 Minutes)
 - Effective in Wide Range of Spray Volumes
 - Liquid and Dry Formulations
- Safest PGR
 - Widespread Usage
 - Safe on Most Grasses
- 50% Yield Suppression Typical

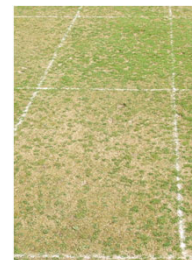


Common Products	
Trinexapac-Ethyl	Primo Maxx
	Governor
Prohexadione-Ca	Anuew

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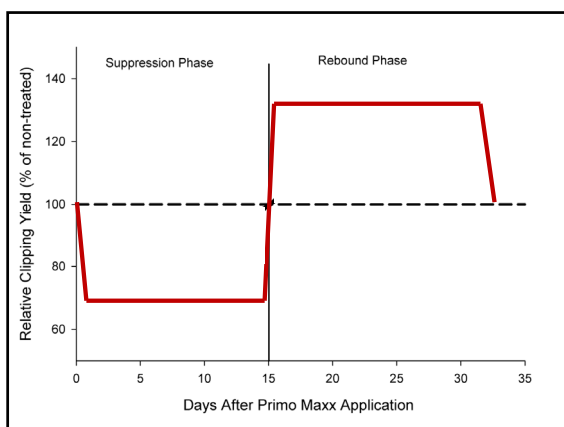
Class B Compounds

- Early Inhibition of Gibberellic Acid
 - Can disrupt other pathways
 - Sterol biosynthesis
- Root Absorption
 - Irrigated in with ¼ inch recommended
- More Phytotoxic
 - Slight Discoloration, *Poa* most sensitive
 - Part of annual bluegrass control
- 50%+ Yield Suppression Typical

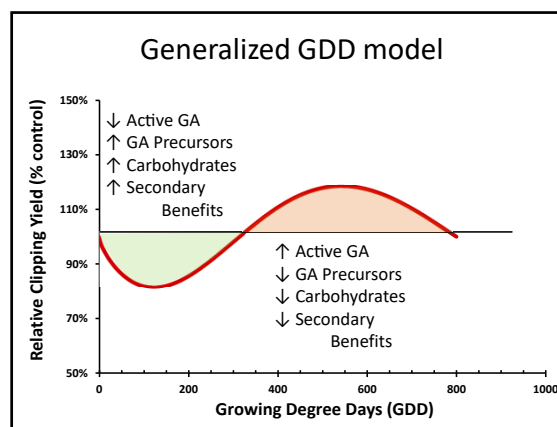


Common Products	
Flurprimidol	Cutless
Paclobutrazol	TGR
Paclobutrazol	Trimmit

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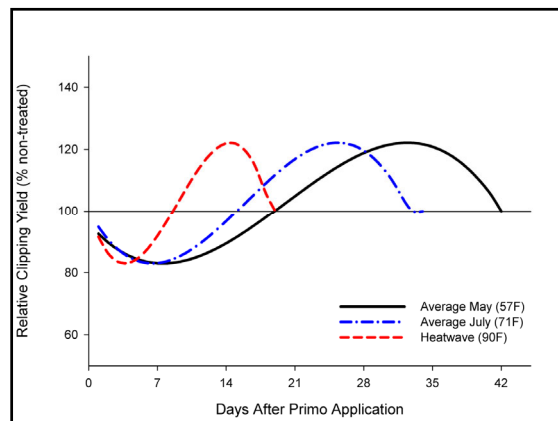
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PGR Metabolism

- **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

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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
 - **GreenKeeperApp.com**

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Growing degree days (GDD) factors in air temp

- Heat units (GDD) predicts TE re-application intervals
- **Calculating GDD**

Date	High (F)	Low (F)	Average (F)	Average (C)	GDD (C)
5/1/20	75	50	63	17	17
5/2/20	72	47	60	15	32
5/3/20	85	65	75	24	56
5/4/20	93	72	83	28	84

– Use GDD Excel tracker now (app in future)

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Modeling Research on Kentucky bluegrass

Active Ingredient	Common Name	Growth Suppression	Ideal GDD
Trinexapac-ethyl	Primo Maxx	25-70%	260-350
Paclobutrazol	Trimmit	20-30%	420-450
Flurprimidol	Cutless	0-10%	~450
Prohexadione-Ca	Anuew	40-45%	280-300
Flurprimidol + Trinexapac-ethyl	Legacy	0-60%	450-500
Flurprimidol + Paclobutrazol + Trinexapac-ethyl	Musketeer	20-25%	350-400

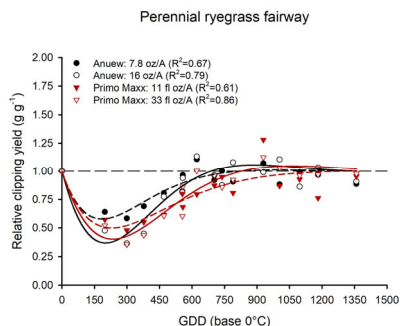
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Use PGR GDDs to avoid over-application

- 300 GDD worked well for KBG
 - Good color and density
 - Plant health benefits
- Higher rates and closer frequencies caused problems
 - Too much growth suppression
 - Reduced wear and traffic tolerance

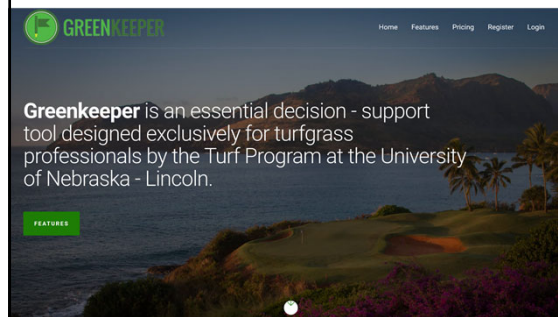
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Same Concepts Apply for Perennial Ryegrass Fields



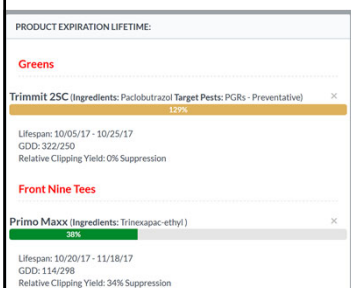
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GreenKeeperApp.com – It's Free! Essential Turf Management App



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GreenKeeper can help plan timing and even rates in the future



- Latest research
 - Use an equation to calculated how much PGR to apply at set intervals
 - GreenKeeper will display the amount to apply
 - Limit the risk of over-suppression

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Do PGRs have a place in lawn care?

- Need to sell a program
 - Avoid the rebound -> or use to your advantage
 - Logistics of separate applications every 3 to 6 weeks
 - Product cost not too great, labor is the issue
 - Who is mowing?
- Thoughts on implementation

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