

MICHIGAN STATE UNIVERSITY Extension

## What Can Tree Growth Regulators Do For You?


Bert Cregg, Ph.D.  
Michigan State University

Department of Horticulture  
Department of Forestry

---

MICHIGAN STATE UNIVERSITY Extension

Trees are responsible for a large portion of unplanned utility outages



---

MICHIGAN STATE UNIVERSITY Extension

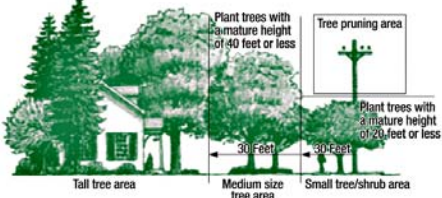
## Options for reducing tree – powerline conflicts

- Planting management
- Mechanical line clearing
- Tree growth regulators

---

MICHIGAN STATE UNIVERSITY Extension

## Planting management



---

MICHIGAN STATE UNIVERSITY Extension

## Mechanical line clearing



---

MICHIGAN STATE UNIVERSITY Extension

## The buzz about Tree Growth Regulators (TGR's)



---

MICHIGAN STATE UNIVERSITY Extension

## The buzz about TGR's

1989 This tree, at the Morton Arboretum, had been declining over a period of a few years at the time of application.

1998 Same tree, now the tree range of fuller and greener than before.

2001 Same tree, the deadwood has been removed and the tree experienced much improved health. No additional applications were made since initial application in 1989.

Healthy Trees

VS.

Drought-Stricken Trees

MICHIGAN STATE UNIVERSITY Extension

## History of utility use of TGR's

- 1950's Edison Electric sponsored research – use of NAA applied to pruned branches
- 1970's EPRI-sponsored research – Morphactins bark sprays used diesel or other carriers

MICHIGAN STATE UNIVERSITY Extension

## History of utility use of PGR's

- 1980's Experimental use permits for:
  - Triazoles
    - Paclobutrazol (Clipper)
    - Uniconazole (Prunit)
  - Pyrimidine
    - Flurprimidol (Cutless implants)

MICHIGAN STATE UNIVERSITY Extension

## Effective height control with PBZ and Uniconazole

Table 1. Species and sites where dikogulac, paclobutrazol, and uniconazole applied by trunk injection had a significant effect on tree growth after 2 and 4 years.\*

Site	Treatment					Probability <sup>a</sup>
	Control	Paclobutrazol	Uniconazole	Uniconazole	Dikogulac	
Growth (Increase in Height)						
16		0.25 g	0.05 g <sup>b</sup>	0.10 g		
Chinese elm ( <i>Ulmus parvifolia</i> )	11.3 ± 2.3X [4]	4.3 ± 3.6Y [4]	3.4 ± 0.3Y [4]	3.2 ± 0.7Y [4]		0.001
80		0.25 g	0.50 g		0.21 g	
Big leaf maple (acer macrophyllum)	8.5 ± 2.2X [3]	10.1 ± 2.1X [3]	4.6 ± 0.2Y [4]	3.3 ± 1.9Y [4]	5.5 ± 2.3X [4]	0.018 0.002
81		1.00 g	0.50 g	1.00 g		
London plane ( <i>Platanus acerifolia</i> )	5.8 ± 1.2X [3]	7.4 ± 2.0X [3]	3.5 ± 0.7Y [3]	2.2 ± 0.8YZ [3]	1.3 ± 0.8Z [3]	0.001 0.024

MICHIGAN STATE UNIVERSITY Extension

## TGR (PGR) Basics

- What are TGR's?
- How do TGR's work?

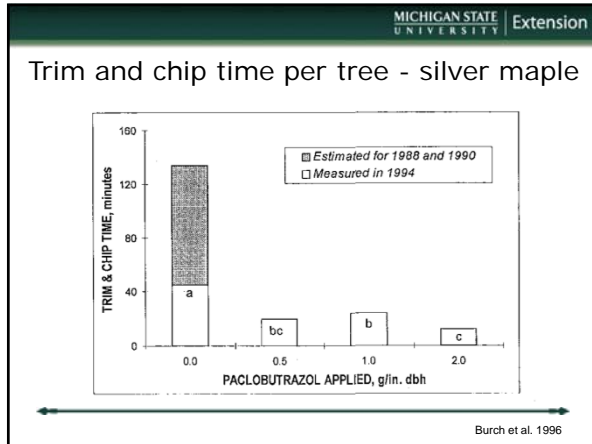
paclobutrazol

MICHIGAN STATE UNIVERSITY Extension

## What are TGR's?

- Plant Growth Regulators
  - Auxins – cell elongation
  - Gibberilins – cell division & elongation
  - Cytokinins – cell division
  - Ethylene generators – ripening
  - Abscisic acid – leaf abscission
  - **Growth retardants – slow growth**





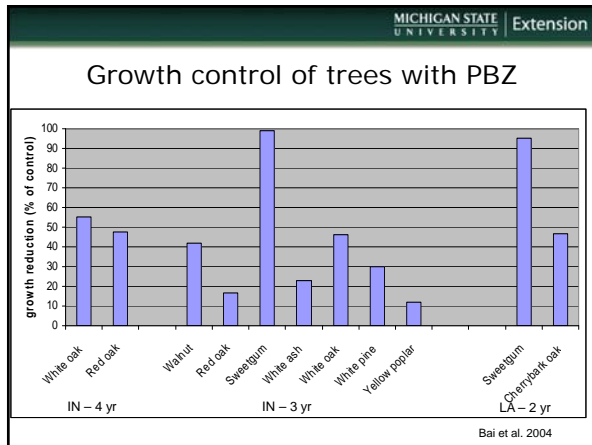
MICHIGAN STATE UNIVERSITY Extension

### Table 3. Estimated percent reduction in trim and chip time over the 10 years from 1984 to 1994.

Species	Paclobutrazol (g/in) <sup>1</sup>			All rates combined
	0.5	1.0	2.0	
Red maple	85	75	78	76
Silver maple	85	82	91	86

<sup>1</sup>rate applied as grams of active ingredient per inch of diameter at breast height

Burch et al. 1996

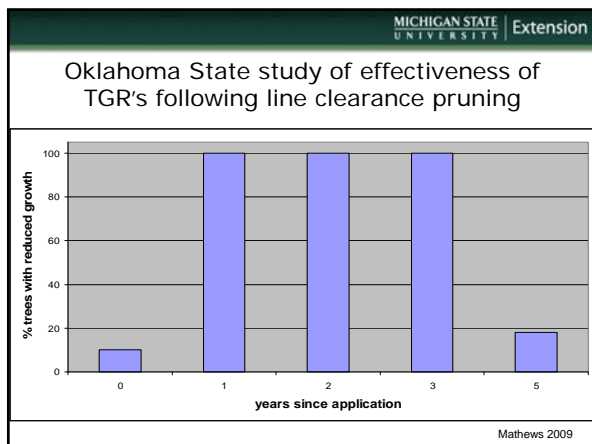


MICHIGAN STATE UNIVERSITY Extension

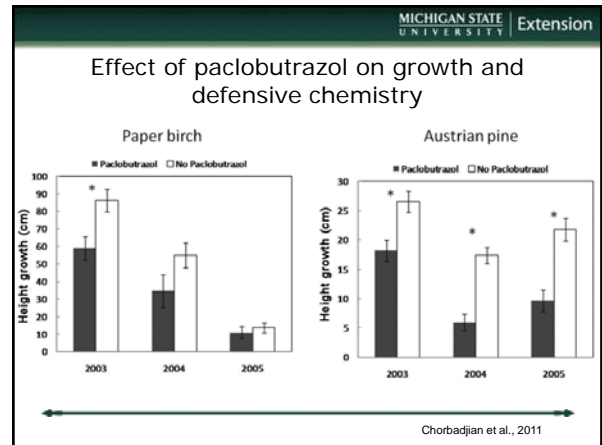
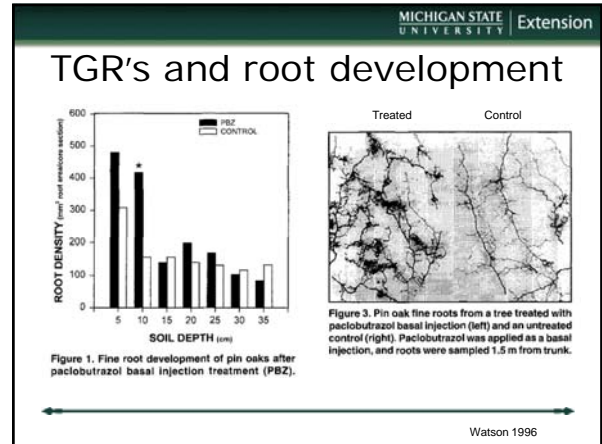
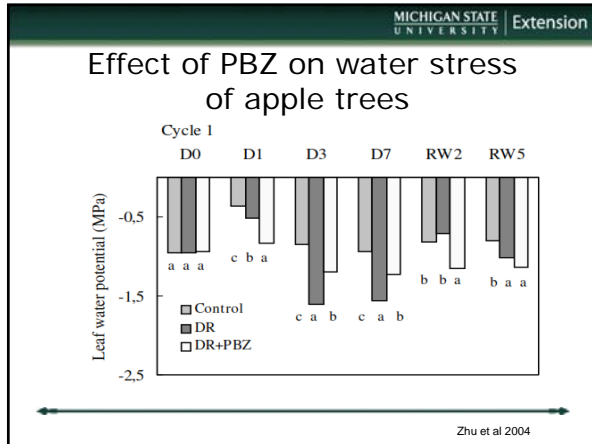
### Oklahoma State University TGR study

- Followed growth control of operational TGR application programs

Burch et al. 1996



- MICHIGAN STATE UNIVERSITY Extension
- ### TGR's in Landscape and Urban Tree Care
- Growth control
  - Drought tolerance
  - Disease and pest resistance
- Burch et al. 1996



### TGR application

- Soil injection
- Soil drench
- Foliar spray

sstree.com

### TGR Application

- Apply anytime soil is not frozen or saturated
- Avoid run-off
- Avoid application to stressed trees

treesforstandscapes.com

MICHIGAN STATE UNIVERSITY Extension

Figure 1. Placement of Profile 2SC as spray or basal drench.

Figure 2. Placement of Profile 2SC as a soil injected treatment.

MICHIGAN STATE UNIVERSITY Extension

**Table 1. Examples of the volumes of Cambistat and Water needed to make Ready-to-Use solution.**

Volume of Cambistat	Volume of Water	Makes
1 qt	11 quarts	3 gallons
1 gallon	11 gallons	12 gallons
4 gallons	44 gallons	48 gallons

MICHIGAN STATE UNIVERSITY Extension

**Important: Rate are species specific!**

**TABLE 1**  
Application Rate Ranges for Diluted Mixture of Profile 2SC for Treatment of Various Tree Species†

50 to 100 ml (1 to 2 grams a.i.) per inch DBH††	100 to 150 ml (2 to 3 grams a.i.) per inch DBH††	150 to 200 ml (3 to 4 grams a.i.) per inch DBH††
Sweetgum Australian Pine	American Basswood Boxelder Elm(s) Eucalyptus Hackberry Littleleaf Linden Locust Maple(s) Oak(s) Sassafras	Ash Bradford Pear Sycamore Tuliptree Weeping Willow Ficus†††

MICHIGAN STATE UNIVERSITY Extension

**MSU TGR research**

- Two projects with Paclobutrazol
  - Christmas tree and conifer nursery
    - Coning
    - Height control
  - Urban stress mitigation
    - Growth control
    - Effect of leaf size
    - Leaf physiology (SPAD, water potential, Ps)

MICHIGAN STATE UNIVERSITY Extension

**MSU Conifer PGR study**

MSU Conifer PGR Study Sites

Field trial  
Container trial

MICHIGAN STATE UNIVERSITY Extension

**Shoot growth of field-grown Fraser fir**

Tree size class	Treatment	Location				Reduction (% of control)
		Manton	Horton	Sydney	Mason	
Size Class: Small (3-4')	Cambistat (200ml)	37.6*	43.4*	24.2*	26.8*	25.3
	Control	44	52.8	38.9	41.1	
Size Class: Medium (4-6')	Cambistat (400ml)	35.4*	44.2*	34.1	28.5*	23.5
	Cambistat (600ml)	37.7	45.2*	25.8	24.8*	28.2
	Cyocel	40.6	53.1	38.9	39.8	7.3
	GA4/7	47.9	55.5	42.2	44.6	-2.3
	Trimtect	32.4*	45.6*	27.1	29.7*	27.5
Size Class: Large (6-7')	Cambistat (600ml)	38.4	47.7*	22.3*	32.4*	21.6
	Control	42.9	58.1	38.5	40.1	

\* Indicates mean is different from control at P<0.05

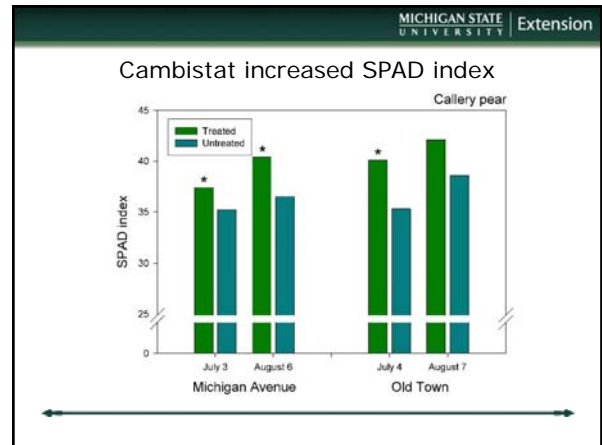
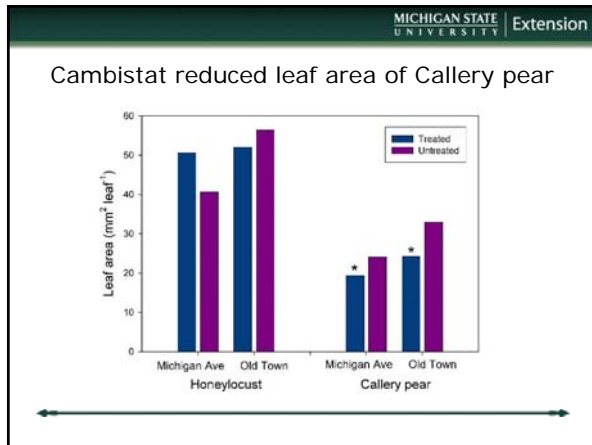
MICHIGAN STATE UNIVERSITY Extension

### Shoot growth of field-grown Spruces

Norway Spruce			
	Treatment	Shoot growth (cm)	Reduction (% of control)
Size Class: Small (3-4')	Cambistat	30.3*	54.8
	Control	67.0	
Blue Spruce			
	Treatment	Shoot growth (cm)	Reduction (% of control)
Size Class: Small (3-4')	Cambistat	16.6*	54.8
	Control	36.7	

\* Indicates mean is different from control at P<0.05

- MICHIGAN STATE UNIVERSITY Extension
- ### MSU TGR research
- Urban stress mitigation
    - 86 trees
    - Mostly pear and Honeylocust
    - Paired plots matched by size and species
    - Rates based on Cambistat label
    - Applied June 27, 2013
    - Scored for Phyto Fall 2013 (none)



MICHIGAN STATE UNIVERSITY Extension

- Photosynthesis and water potential
  - No consistent trends to date

- MICHIGAN STATE UNIVERSITY Extension
- ### Potential negative impacts of TGR's
- Phytotoxicity
  - Inconsistent control
  - Over-regulation
  - Environmental impacts



MICHIGAN STATE UNIVERSITY Extension

PURDUE UNIVERSITY PURDUE EXTENSION  
FNH-252-W EXPERT REVIEWED

### Growth Retardants: A Promising Tool for Managing Urban Trees

William R. Chaney, Professor of Tree Physiology  
Department of Forestry and Natural Resources  
Purdue University, West Lafayette, IN 47907

Trees and shrubs often grow too large for the available space in urban areas. In the past, costly mechanical trimming was the sole method available to arborists and utility foresters to reduce tree and shrub size. Consequently, chemical growth retardants were developed as an inexpensive approach to limit size and the growth rate of trees and, at the same time, to enhance their tolerance to the harsh environmental conditions of urban areas.

Impermeable for trunk injection. Due to their low water solubility, it was considered necessary to dissolve the new generation of growth retardants in either methyl or isopropyl alcohol. The active ingredients of these formulations were unacceptably effective in reducing tree growth. After several years of use throughout the United States in the 1980s, problems associated with trunk injection began to appear. Cracks in the bark and cambium, weeping from injection holes, and internal wood discoloration due to the alcohol carriers led to disenchanted utility arborists.

**History of Tree Growth Retardants (TGRs)**

MICHIGAN STATE UNIVERSITY Extension

SePRO Tree Specialty Products SePRO

## Profile 2SC

Tree Growth Regulator

### How TGRs can change the way you manage trees.

MICHIGAN STATE UNIVERSITY Extension

## Summary

- Effectiveness of PBZ for tree height control is well-established
- Rates are species-specific (read and follow label!)
- Height control varies (up to 90+%)
- Effect typically last 4 years

MICHIGAN STATE UNIVERSITY Extension

## Summary (continued)

- Additional benefits of PBZ?
  - Improved
    - Drought tolerance
    - Pest resistance
    - Leaf color
- Some evidence but less consistent
- Best viewed as secondary benefits

MICHIGAN STATE UNIVERSITY Extension

## Acknowledgements

- USDA SCRI Block Grant
- MDARD
- Rainbow Scientific
- Michigan Christmas Tree Association
- Dana Ellison
- Brent Crain
- Nicole Rowley
- Devon Berry