

# Groundline decay prevention with Non-toxic Materials

J. Chad Roper<sup>1</sup>, Camille Freitag<sup>2</sup>,  
John C. Goodman<sup>3</sup>, Jeff Morrell<sup>2</sup>,  
and Frederic K. Pfaender<sup>4</sup>

1. Triangle Laboratories, Inc., Durham, NC

2. Oregon State University, Corvallis, OR

3. Duke Energy Company, Charlotte, NC

4. University of North Carolina at Chapel Hill

# Goals

- ✍ **Tell the story of a new approach to groundline decay prevention**
- ✍ **Explain how time-release carbon source amendment preserves wood**
- ✍ **Show the data collected**
- ✍ **Answer questions**

# Concept

## **Frederic K. Pfaender, Ph.D**

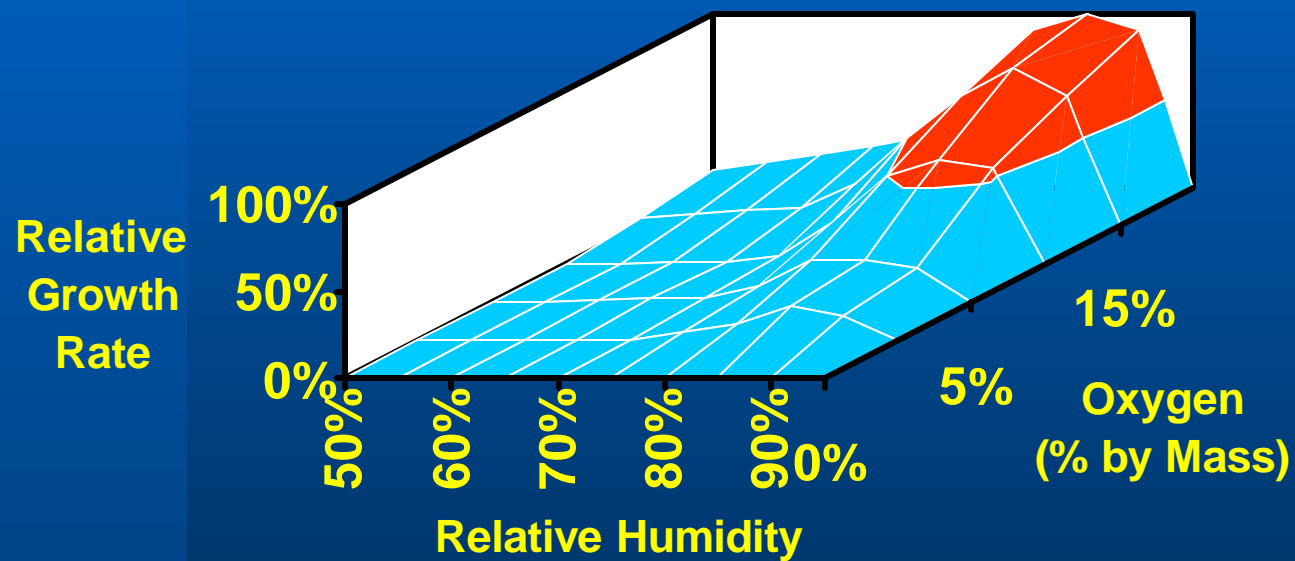
- Department of Environmental Sciences and Engineering, UNC - Chapel Hill
- 25+ years microbiology research
- recognized expert in pollutant biodegradation

## **Learned what conditions favor decay**

## **Learned what conditions are unfavorable to decay**

## **Decided to apply that knowledge to wood**

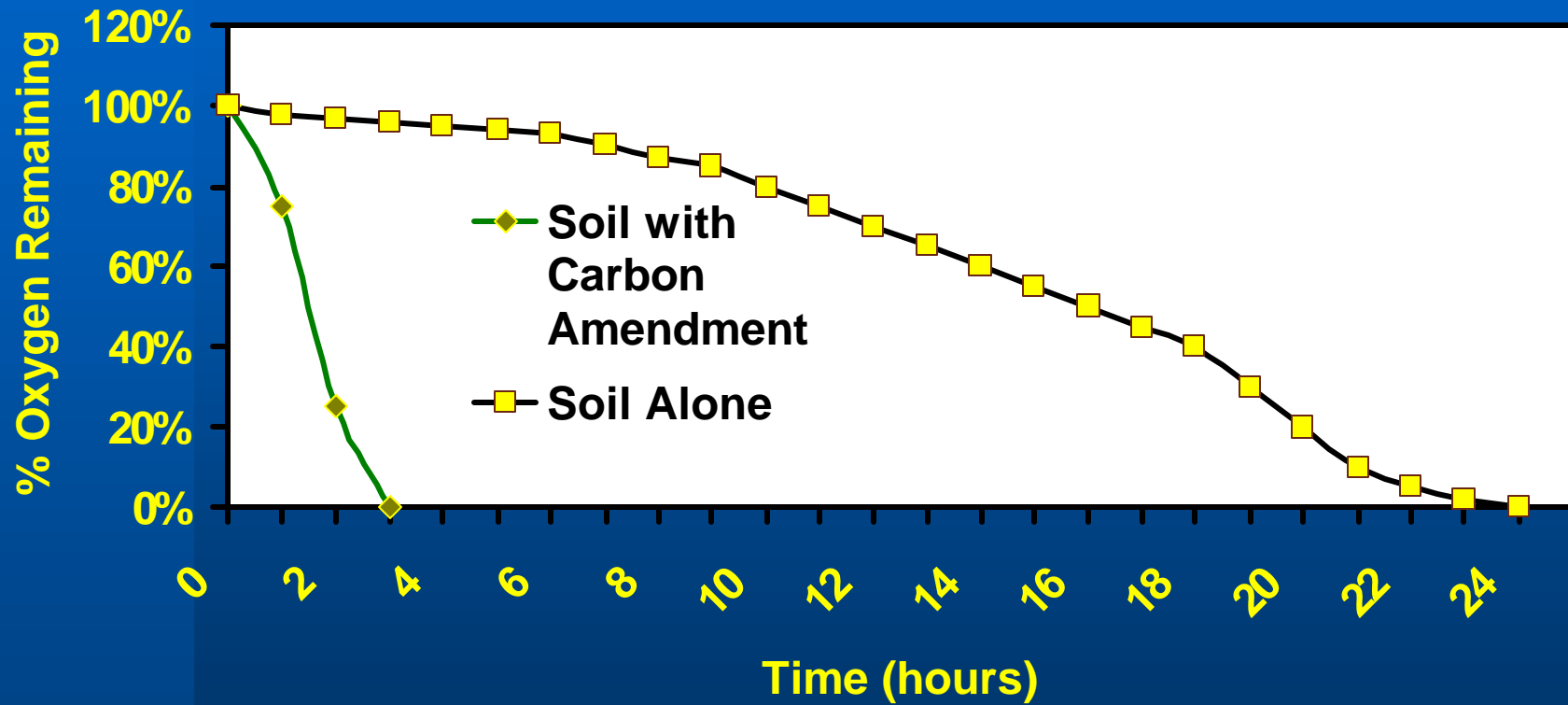
# Effect of Moisture and Oxygen on Microbial Growth in Soil



# Making conditions unfavorable for decay

- ✍ **Wood decay needs oxygen, moisture, and fungi**
- ✍ **Moisture content regulates oxygen in soil**
  - **Soil bacteria and fungi deplete oxygen under wet conditions**
- ✍ **Fungi need both oxygen and moisture to grow and compete for these with bacteria**

# Oxygen Consumption Rates



# Controlling the microbial community in soil

- ✍ Wood is composed of cellulose and lignin
- ✍ Fungi are needed to degrade the lignin
  - there are no known bacteria capable of lignin degradation
- ✍ Fungi require oxygen and can't compete with bacteria when feeding on a simple carbon source
  - the bacteria reproduce faster and thrive when there are simple carbon sources present
- ✍ Bacteria can overpower fungi in a system whenever the carbon sources are simple and abundant

# How does carbon source amendment work?

## Depletes oxygen

- Anaerobic conditions are created more quickly
- Anaerobic decay is 5-10 times slower than aerobic decay
- More anaerobic days means slower overall decay

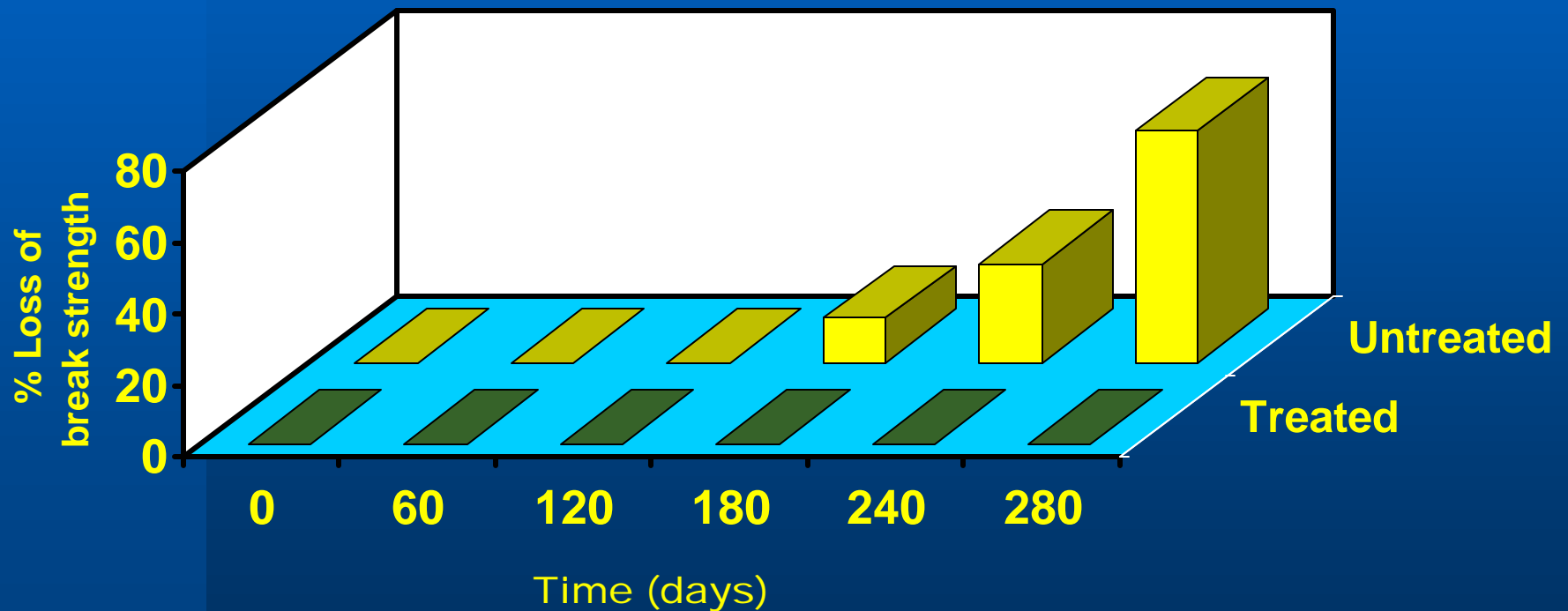
## Changes microbial community

- Fungi are required for lignin degradation
- Fungi require oxygen and compete with bacteria for nutrients in soil
- carbon source amendment stimulates bacteria and reduces oxygen, thereby reducing the numbers of decay fungi

## Creates unfavorable conditions for wood decay

# Laboratory Testing

Loss of break strength in laboratory microcosm studies using 0.5" diameter untreated southern yellow pine



# Putting carbon source amendment to work

- ✍ **Impractical to apply simple carbon sources to field sites frequently**
- ✍ **Needs a delivery technology**
- ✍ **A time-release carrier to give 7-10 years treatment life**
- ✍ **Needs to release carbon source when biological activity is high (moist, warm etc.)**

# Time-release

- ✍ **Rely on biodegradation**
- ✍ **Encase carbon source in a biodegradable matrix**
- ✍ **As carrier degrades the carbon source is released**
- ✍ **Releases carbon source when biological activity is high**
- ✍ **Lifespan is dictated by 'degradability' of the matrix material**

# Product

- ✍ **All of the ingredients are on the Food and Drug Administration (FDA) generally regarded as safe (GRAS) list**
- ✍ **An easy to install bar shape (could be installed without excavation)**
- ✍ **No environmental liability**
- ✍ **Reduction in the use of toxic materials**
- ✍ **Safe handling, transport, and storage**

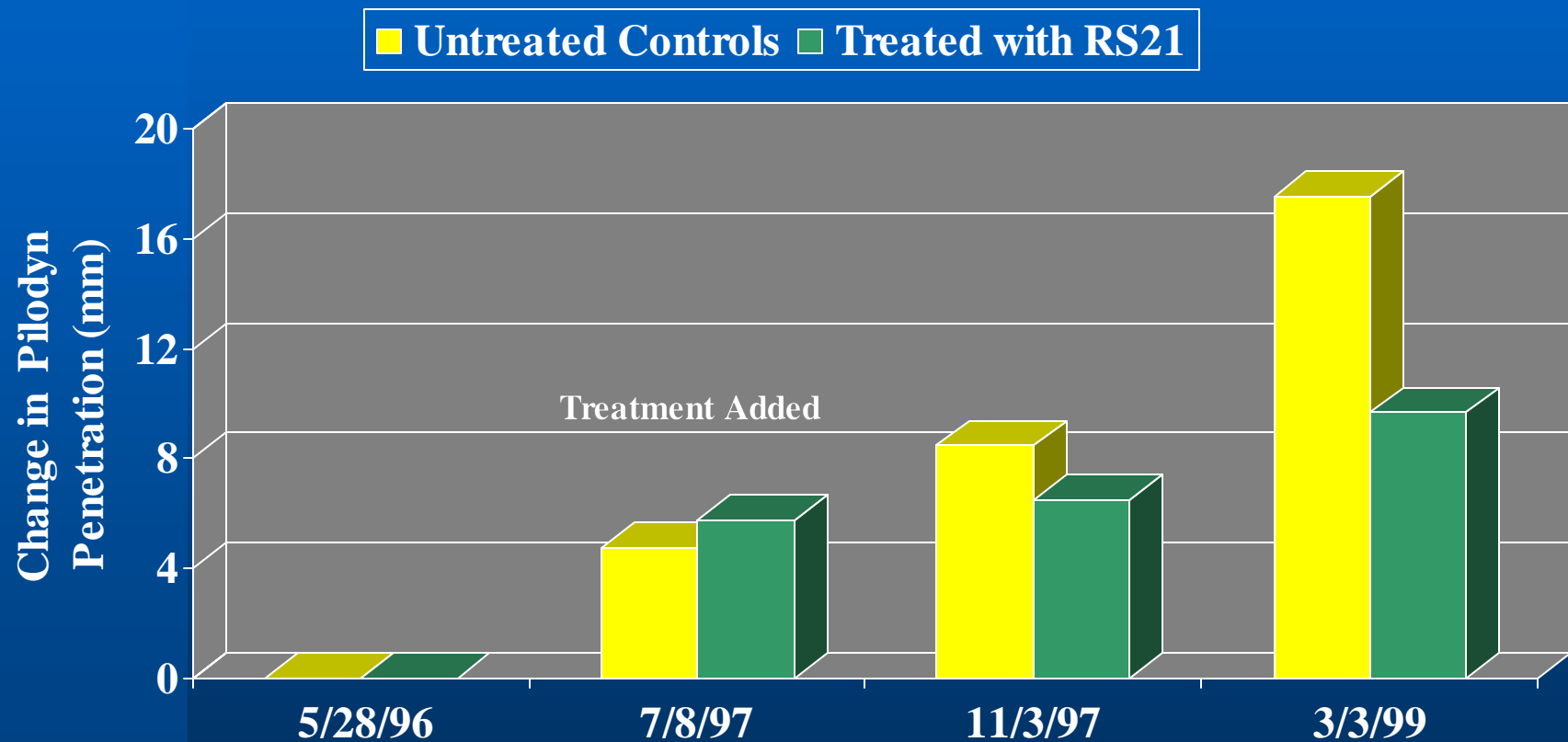
# Patents

- ✍ **“Environmentally friendly treatments to extend the functional life of wood structures and novel treated wood structures” U.S. Patent #5,770,265**
- ✍ **“Time release delivery system” U.S. Patent #6,004,572**

# Field Testing

- ✍ 1.5" x 1.5" by 12" rods (approximately 1 lb. ea)
- ✍ Installed at a rate of 1 rod for every 6" of pole circumference
- ✍ Untreated southern yellow pine stubs were used in North Carolina, Douglas Fir in Oregon
- ✍ Wood strength tested with Pilodyn (greater penetration is an indication of greater decay)
- ✍ Three year study, Oregon Study in its 1st year

# Field Trial in North Carolina



RS21

# Thin Sections

Untreated Controls

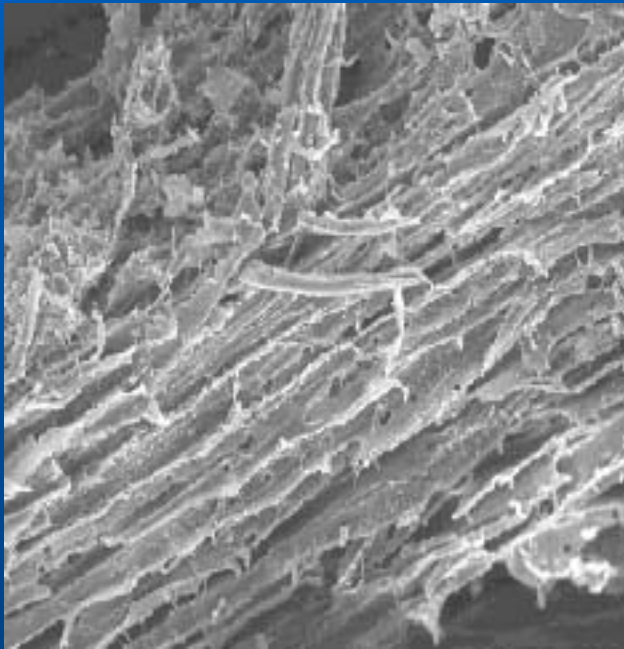


Treated with RS21

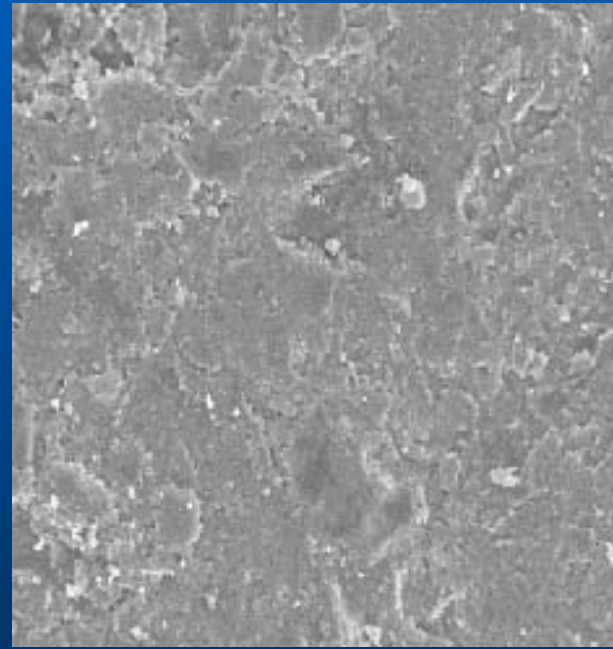


# Electron Micrographs

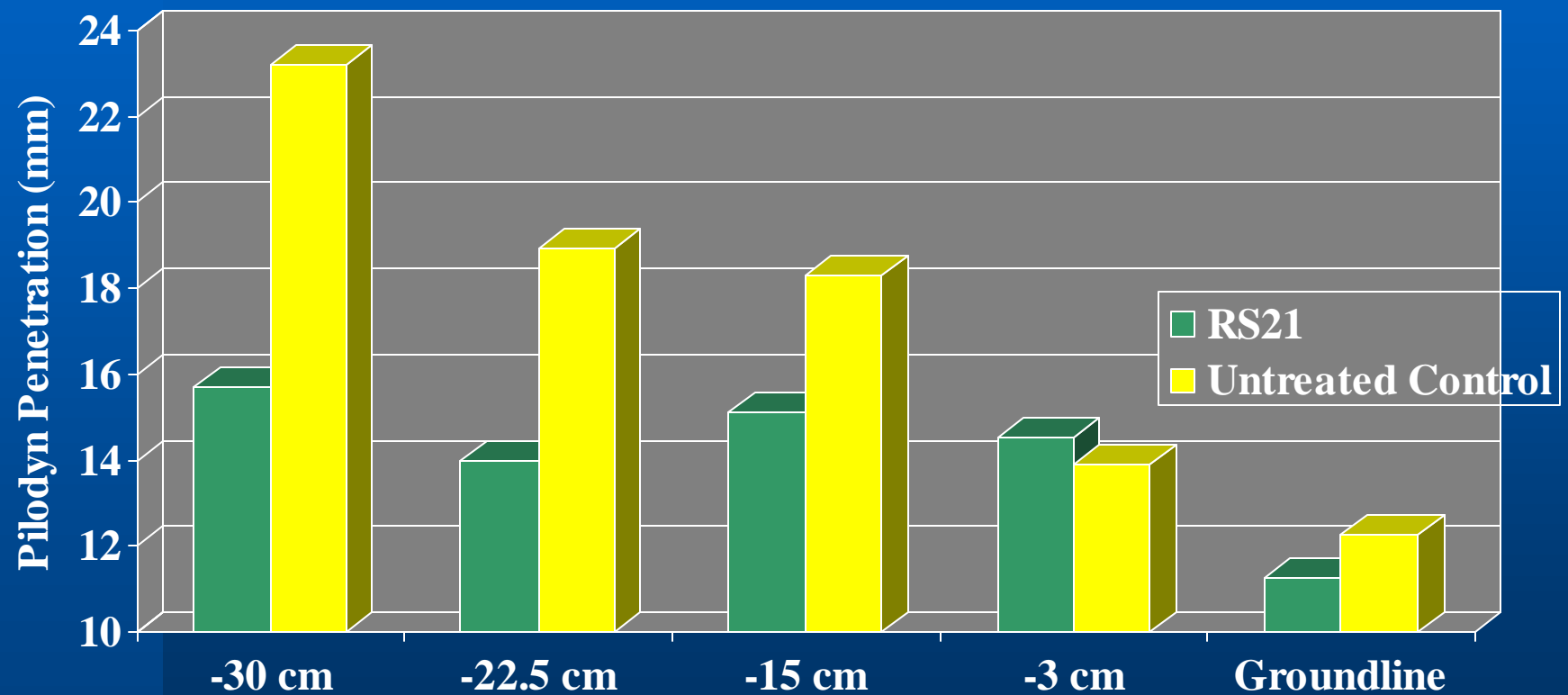
Untreated Controls



Treated with RS21

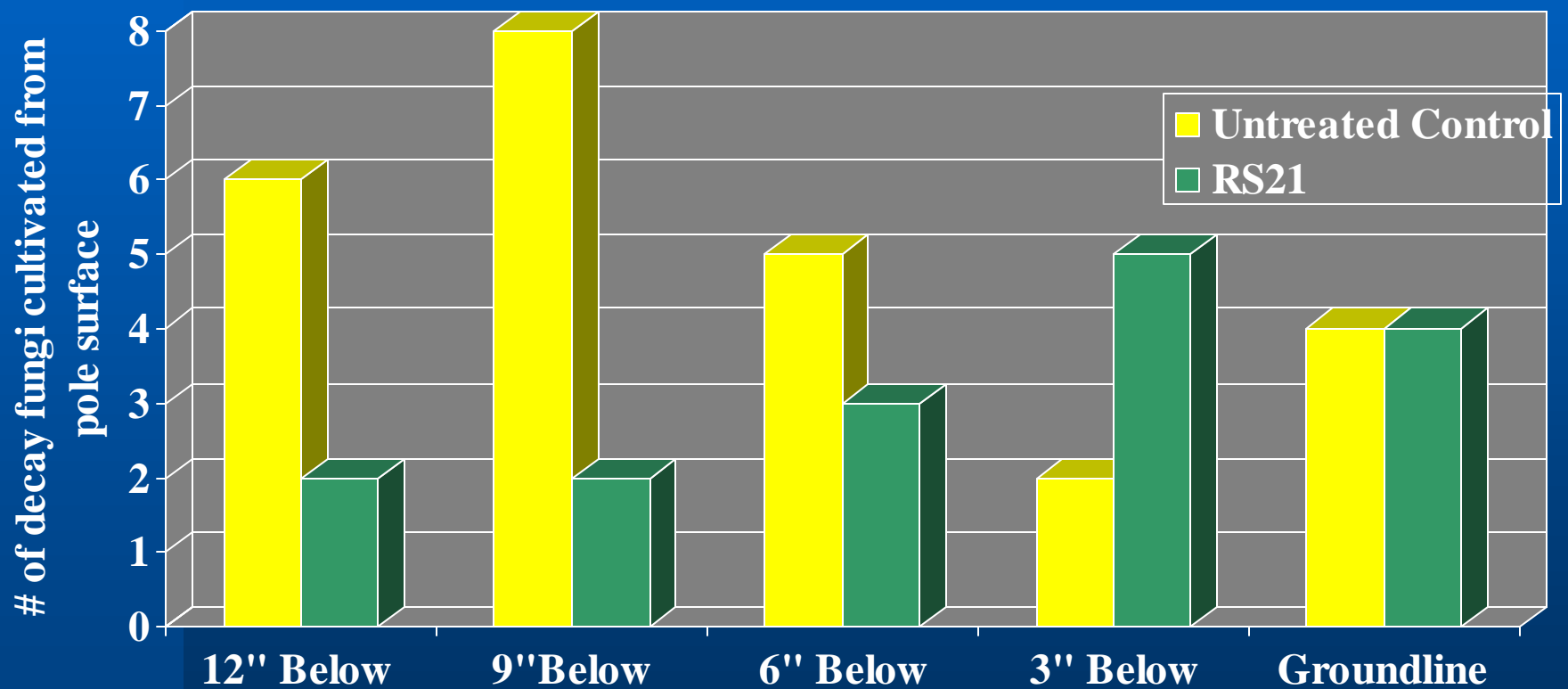


# Field Trial in Oregon (1st Year)



RS21

# Decay Fungi from Oregon Field Trial (1st Year)



# RS21

## **Doubles the lifetime of wood poles**

- Reduces replacement costs by 1/3 or more over time

## **Is Non-toxic**

- Safe for workers, transporters
- Safe for customers
- Reduces your use of toxic materials

## **Installs easily**

- Installs faster and with less effort

# For More Information

## **Contact: Chad Roper**

- Triangle Laboratories, Inc.
- 801 Capitola Dr., Durham, NC 27713
- (919) 544 5729 xt. 248

## **Visit our website:**

**[www.RS21ForWood.com](http://www.RS21ForWood.com)**