The Use Of Proline® (Prothioconazole) To Control Forest Nursery Diseases

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Southern United States – Approximately 1 Billion seedlings are grown annually for reforestation.

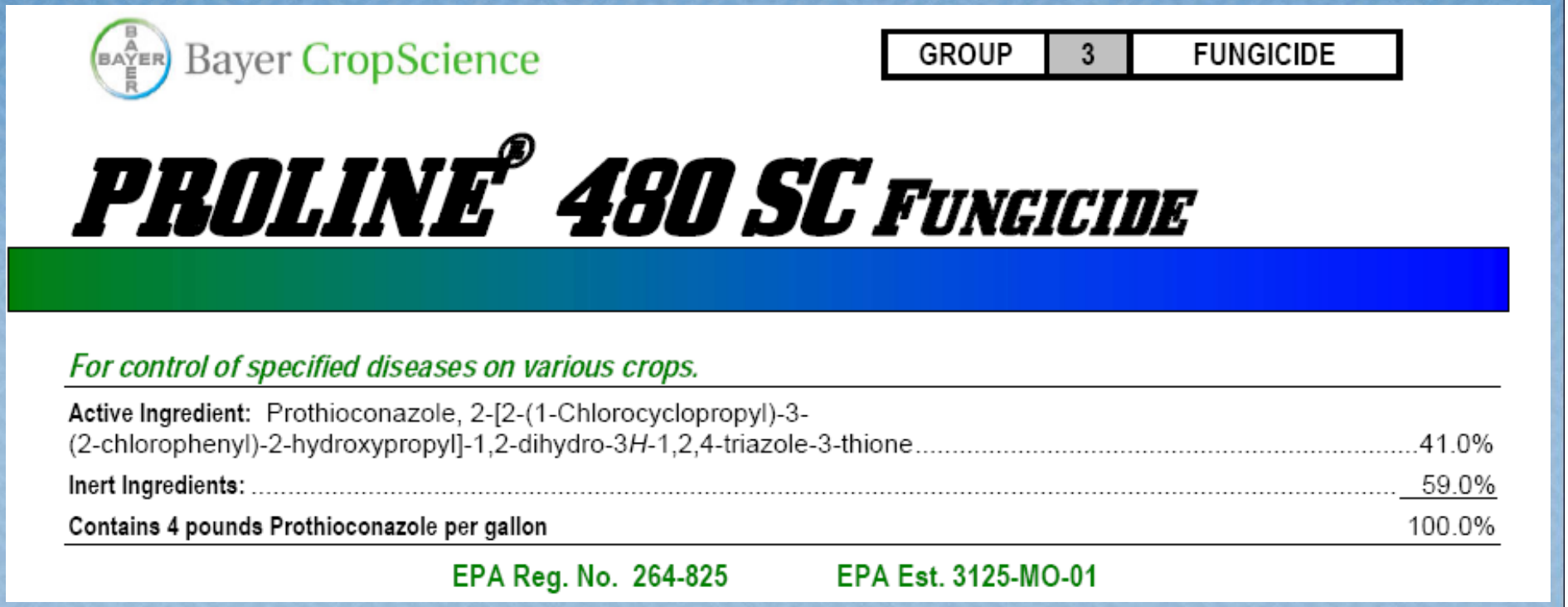
Seeds are sown in April and seedlings ready for field planting by December.

Forest Nursery Seedling Diseases

Fusiform Rust

Pitch Canker

Rhizoctonia Foliar Blight



Prothioconazole was introduced at the Brighton Conference in 2002.

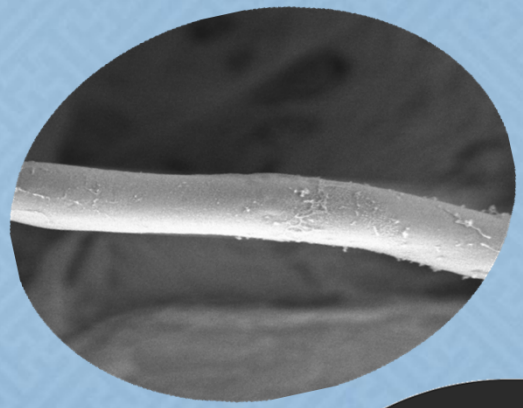
Proline® was registered in the USA on March 27, 2007.

Prothioconazole

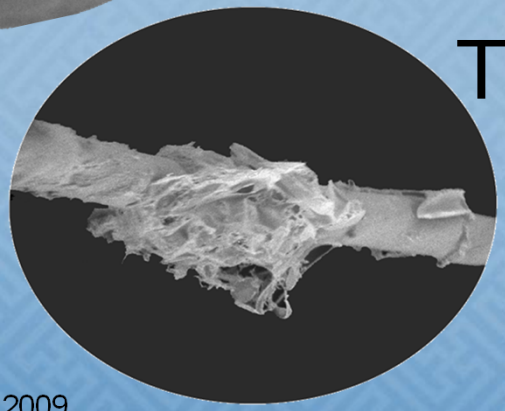
- Prothioconazole is xylem and phloem systemic
- Long-term protectant on the leaf surface
- Unique greening effects not seen with other azoles
- Stops fungal appressoria and haustoria formation, mycelial growth and spore formation
- Has shown good fungicidal activity in the control of ascomycetes, basidiomycetes, and deuteromycetes

Prothioconazole

- Inhibits the production of sterols (DMI) in the fungus which eventually results in abnormal fungal growth and death.



Untreated fungal hyphae

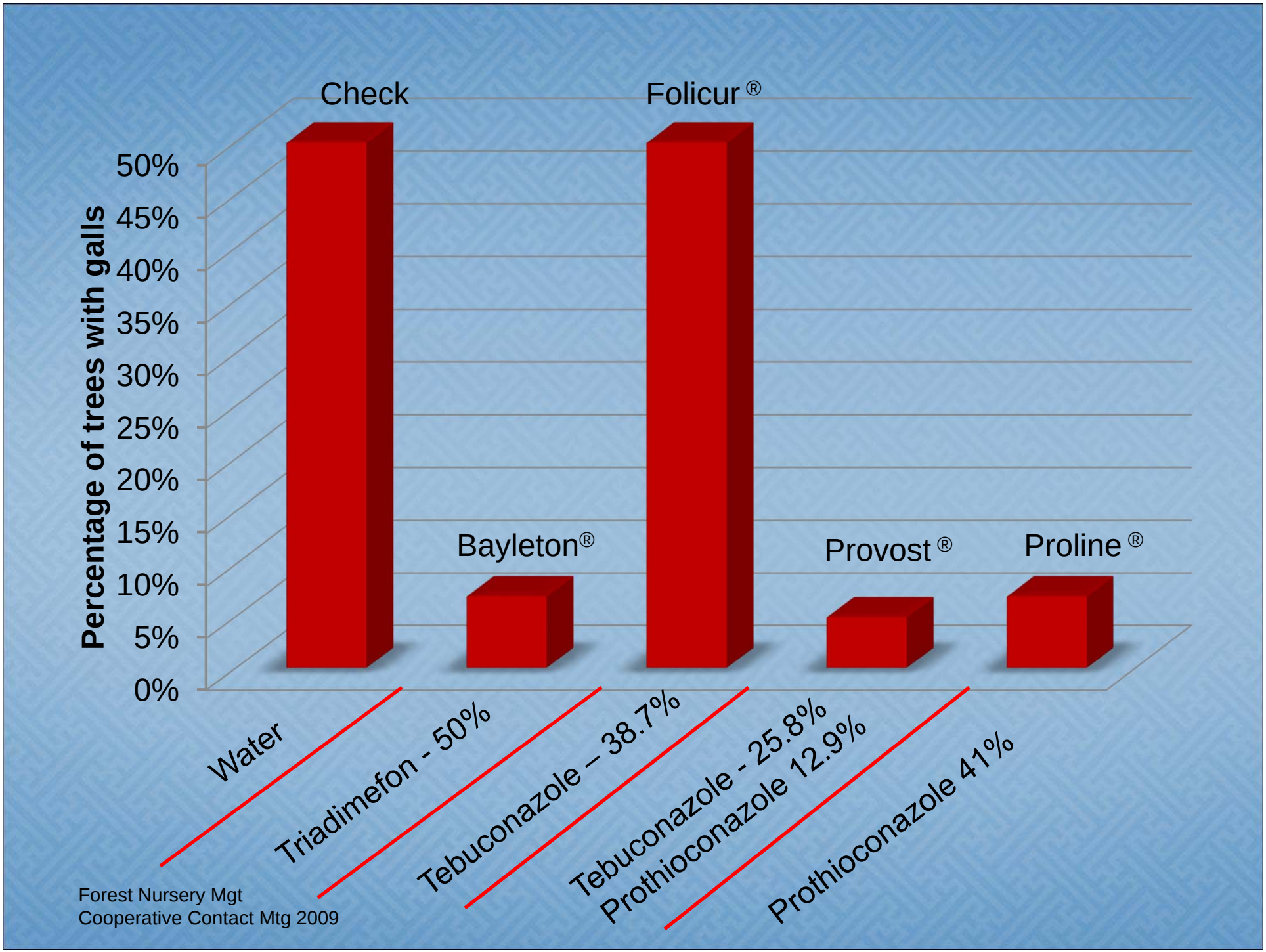


Treated fungal hyphae

Dr. Frank P. Wong Cooperative Extension Specialist
University of California

Fusiform Rust

Cronartium quercum
f. sp. *fusiforme*



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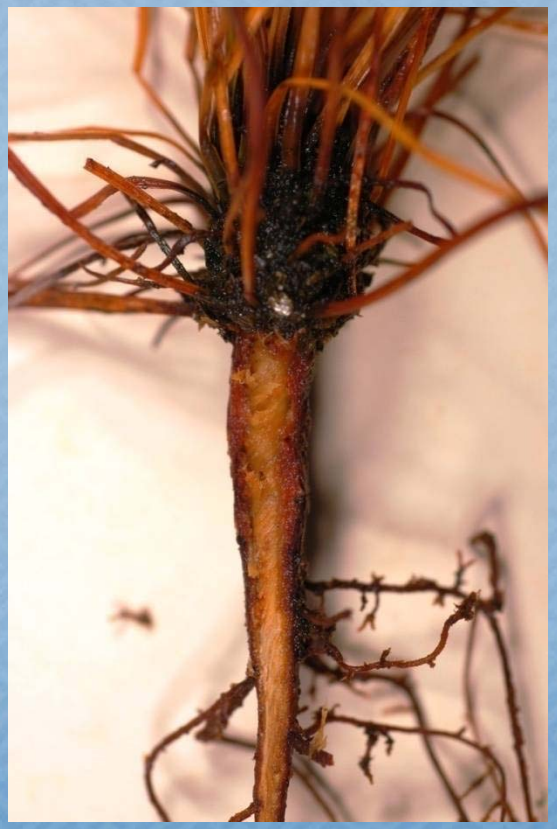
Fusiform Rust

- 3rd year of testing prothioconazole
- 2 years Lob & Slash
- This year looking at interval between applications.
- 2008 - Shellman, Ga. Proline, Provost & Bayleton 0% galls. Control - 54%
- 2009 - Shellman, Ga.
  - Proline & Bayleton

Pitch Canker

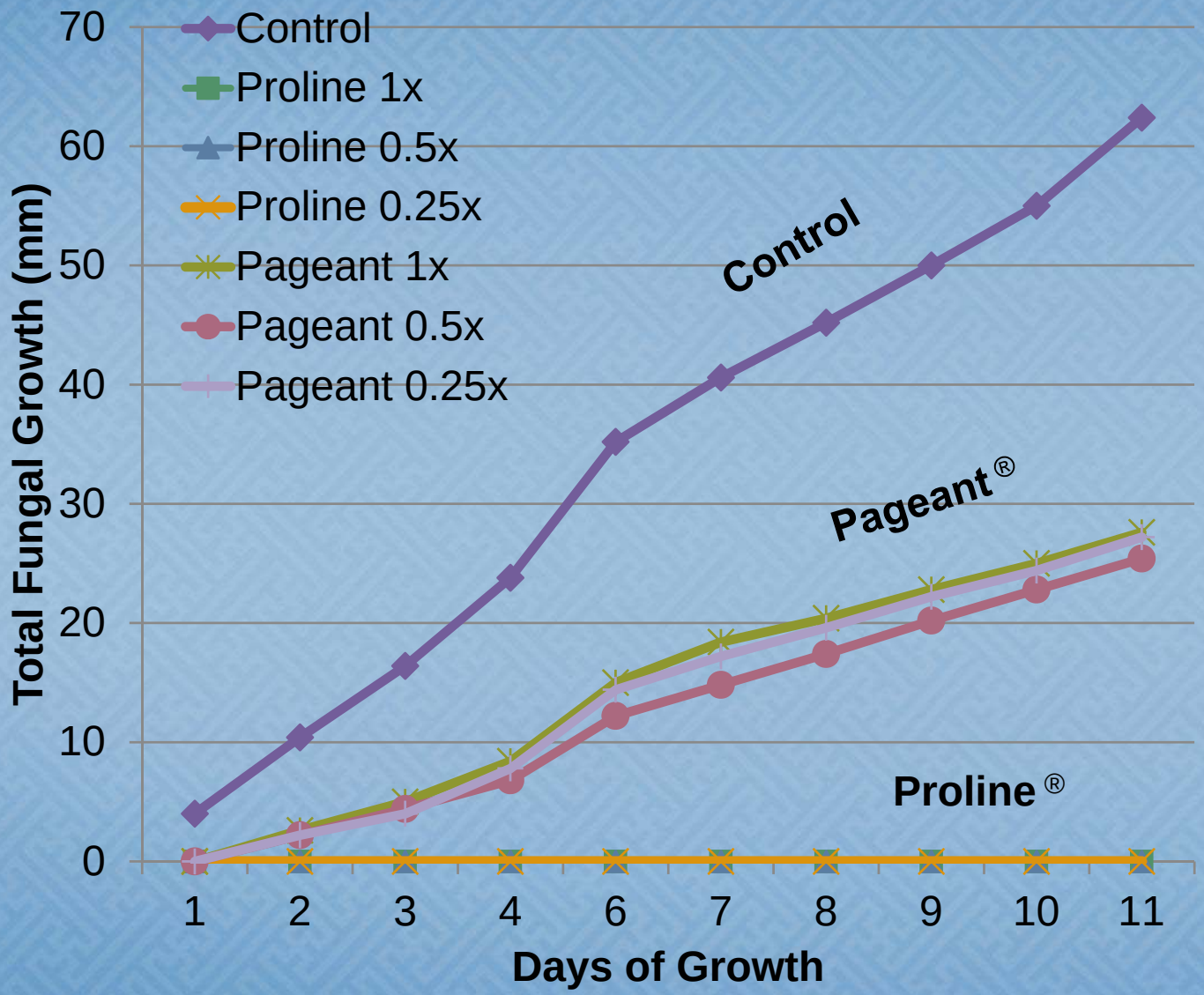
Fusarium circinatum



Pitch Canker

- Lab study
  - *in vitro* fungal growth on amended PDA agar
  - Proline® - 2008 - 3 rates, 1x, 0.5x and 0.25x label rate
  - Proline® - 2009 - 5 rates, 1x, 0.5x, 0.25x, 0.125x and 0.0625x label rate
  - Pageant ® (pyraclostrobin 12.8% & boscalid 25.2%) - - 2008 - 3 rates, 1x, 0.5x and 0.25 x label rate
  - 20 plates for each fungicide/rate

Growth of Fusarium circinatum on Amended Media 2008



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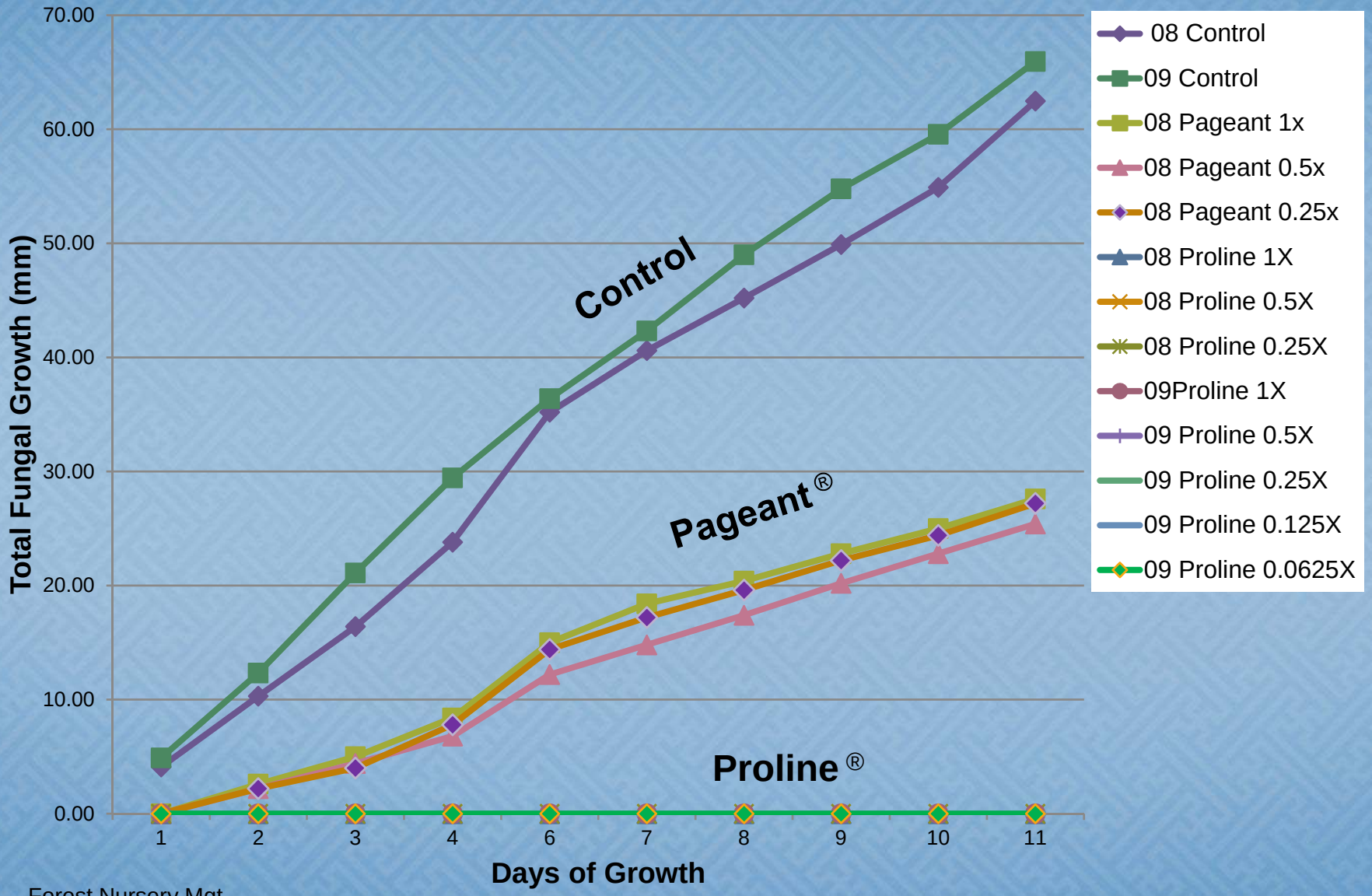
Growth *of Fusarium circinatum* on Amended Media 2008 & 2009



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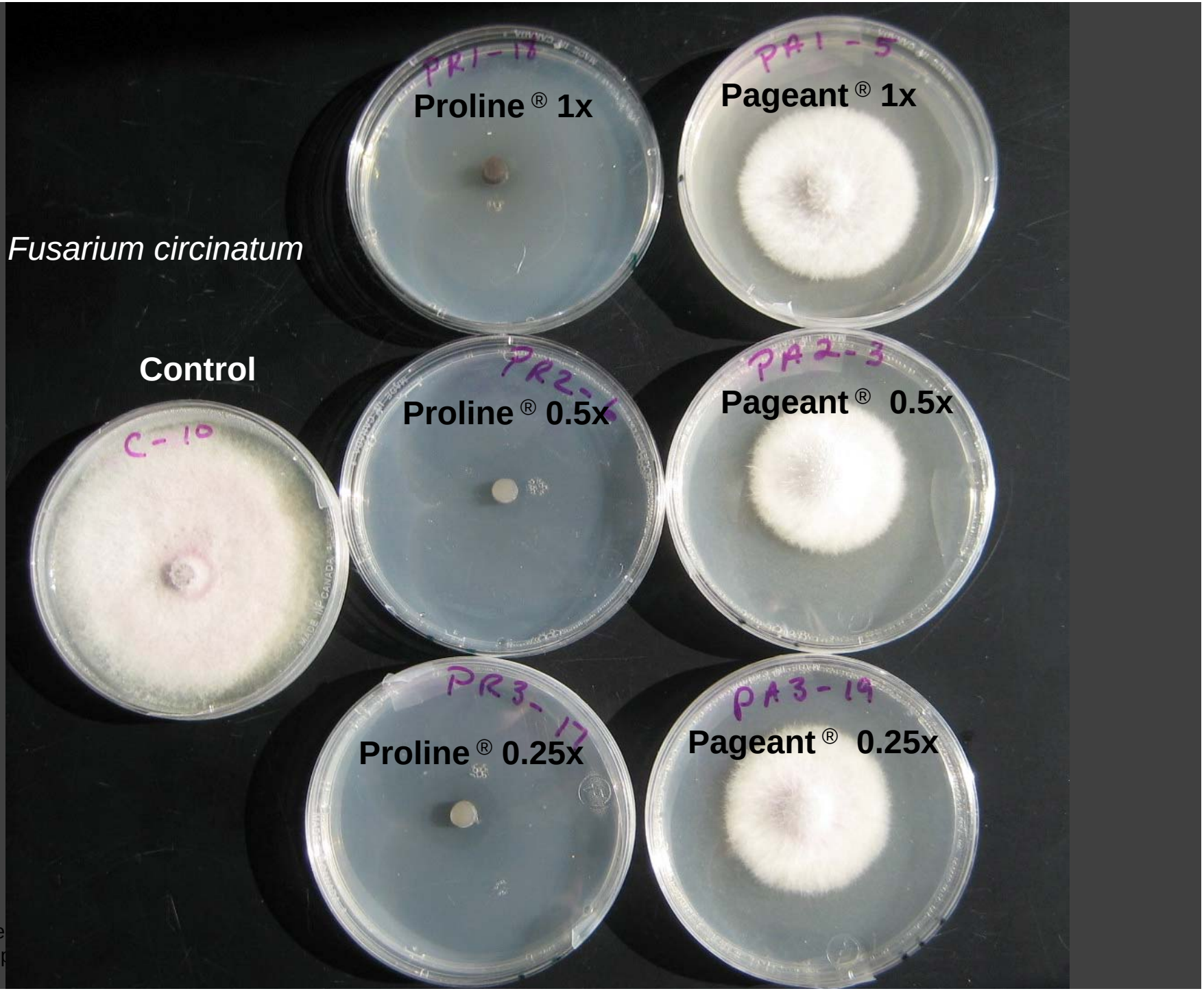
Fusarium circinatum
Control
C-10
Proline® 1x
PR1-18
Pageant® 1x
PA1-5
Proline® 0.5x
PR2-6
Pageant® 0.5x
PA2-3
Proline® 0.25x
PR3-17
Pageant® 0.25x
PA3-19

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Coop

When plug is placed back on unamended media – no regrowth

Proline + *Fusarium* = Fungicidial

2008 Pitch Canker

- **<u>Greenhouse Study</u>**
- Longleaf seed from a family confirmed to have had Pitch Canker in the past was used.
- To increase fungal pressure, an 8mm agar plug containing *Fusarium circinatum* was added to ½ of the cavities at time of sowing.
- Treatments:
    1. Fungal plug added, no Proline® spray
    2. Fungal plug added , Proline® spray
    3. No fungal plug added, no Proline® spray
    4. No fungal plug added, Proline® spray
- Proline® sprayed at sowing and every 2 wks following germination @ label rate.

Final Seedling Measurements

	Longleaf	Shoot		Dry Weight
	Percentage of Cavities Filled	Height (in)	RCD (mm)	Shoot (g)
Fungal Plug + Proline®	79 A	12.6 A	4.6 A	1.40 A
Fungal Plug No Proline®	62 C	11.1 B	4.7 A	1.23 B
No Fungal Plug + Proline®	80 A	12.5 A	4.7 A	1.42 A
No Fungal Plug No Proline®	69 B	11.4 B	4.3 B	1.22 B
lsd	*7*	*0.5*	*0.2*	*0.11*

2009 Pitch Canker

- **Greenhouse Study**
- Longleaf , Loblolly, Slash, Shortleaf .
- To increase fungal pressure, an 8mm agar plug containing *Fusarium circinatum* was added to ½ of the cavities at time of sowing.
- Treatments:
    1. Fungal plug added, no Proline® spray
    2. Fungal plug added , Proline® spray
    3. No fungal plug added, no Proline® spray
    4. No fungal plug added, Proline® spray
- Proline® sprayed at sowing and every 2 wks following germination @ label rate.

2009 Pitch Canker Results as of 6/16/09

	Longleaf	Loblolly	Slash	Shortleaf
Fungal Plug + Proline®	86.1 a	96.9 a	93.1 a	95.6 a
Fungal Plug No Proline®	77.2 b	95.3 a	85.8 b	89.2 b
No Fungal Plug + Proline®	88.9 a	95.6 a	91.7 ab	95.8 a
No Fungal Plug No Proline®	84.2 a	94.2 a	89.2 ab	90.0 b
lsd	*5.4*	*3.1*	*5.6*	*4.2*

Rhizoctonia Foliar Blight

Rhizoctonia in the *Certobasidium* anastomosis group CAG-3

Rhizoctonia Foliar Blight

- Longleaf & loblolly pine are susceptible
- Within any one nursery – isolated disease foci rather than entire beds
- Disease becomes a problem when:
  1. Seedling canopy closes
  2. Extended periods of free moisture
  3. Average daily temperatures is around 80°F and falling
  4. Worse in 2nd crop year
- Fungicides applied every 2 wks - July 15 – Sept 15.
  1. Proline®
  2. Heritage® - 50% azoxystrobin

← Control

Proline® →

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Rhizoctonia Foliar Blight Results

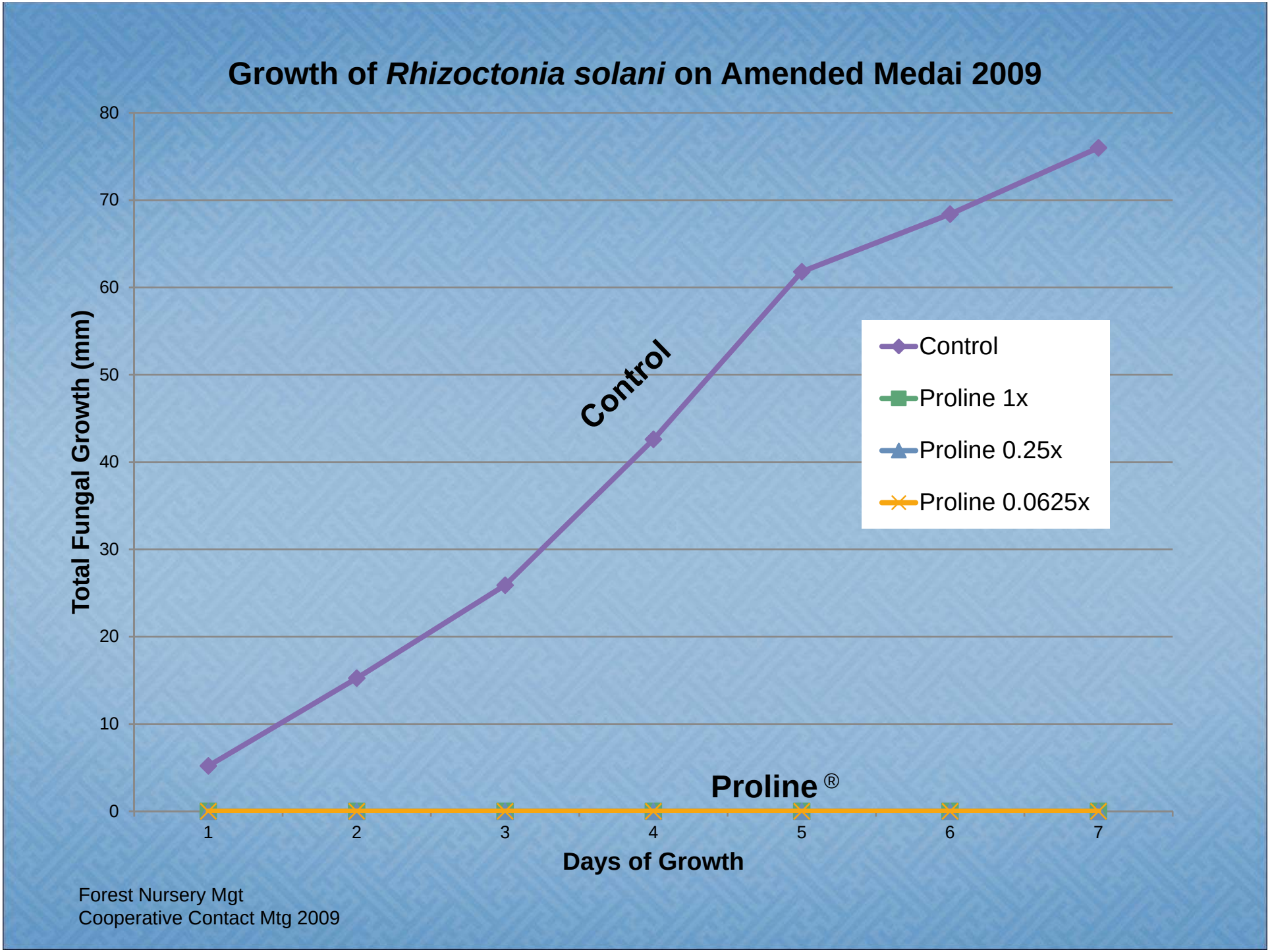
TRT	Seedling Density per sq ft	Disease Incidence[1]	Disease Severity[2]	Seedling loss per sq. ft.[3]	Potential Loss per Acre
Control[4]	22.9 (0.81)	0.354 (0.14)	0.182 (0.07)	3.0 (1.42)	$4,400
Heritage®	23.6	0.162	0.083	1.2	$1,700
Proline®	23.7	0.003	0.001	0.01	$18
Prob > F	*0.7762*	*0.0004*	*0.0004*	*0.0031*	-

[1] Incidence = proportion of bed feet within a 1x4' frame with Rhizoctonia Foliar Blight
[2] Severity = proportion of tissue affected by Rhizoctonia Foliar Blight
[3] Seedlings loss= # trees/drill x incidence/drill x severity /drill x seedling density

[4] Controls were not included in the statistical analysis due to lack of replication among blocks . Number in parenthesis is standard error of the mean.

Rhizoctonia

- Lab study
  - *in vitro* fungal growth on amended PDA agar
  - Proline® - 2009 - 3 rates, 1x, 0.25x and 0.0625x label rate
  - 20 plates for each fungicide/rate



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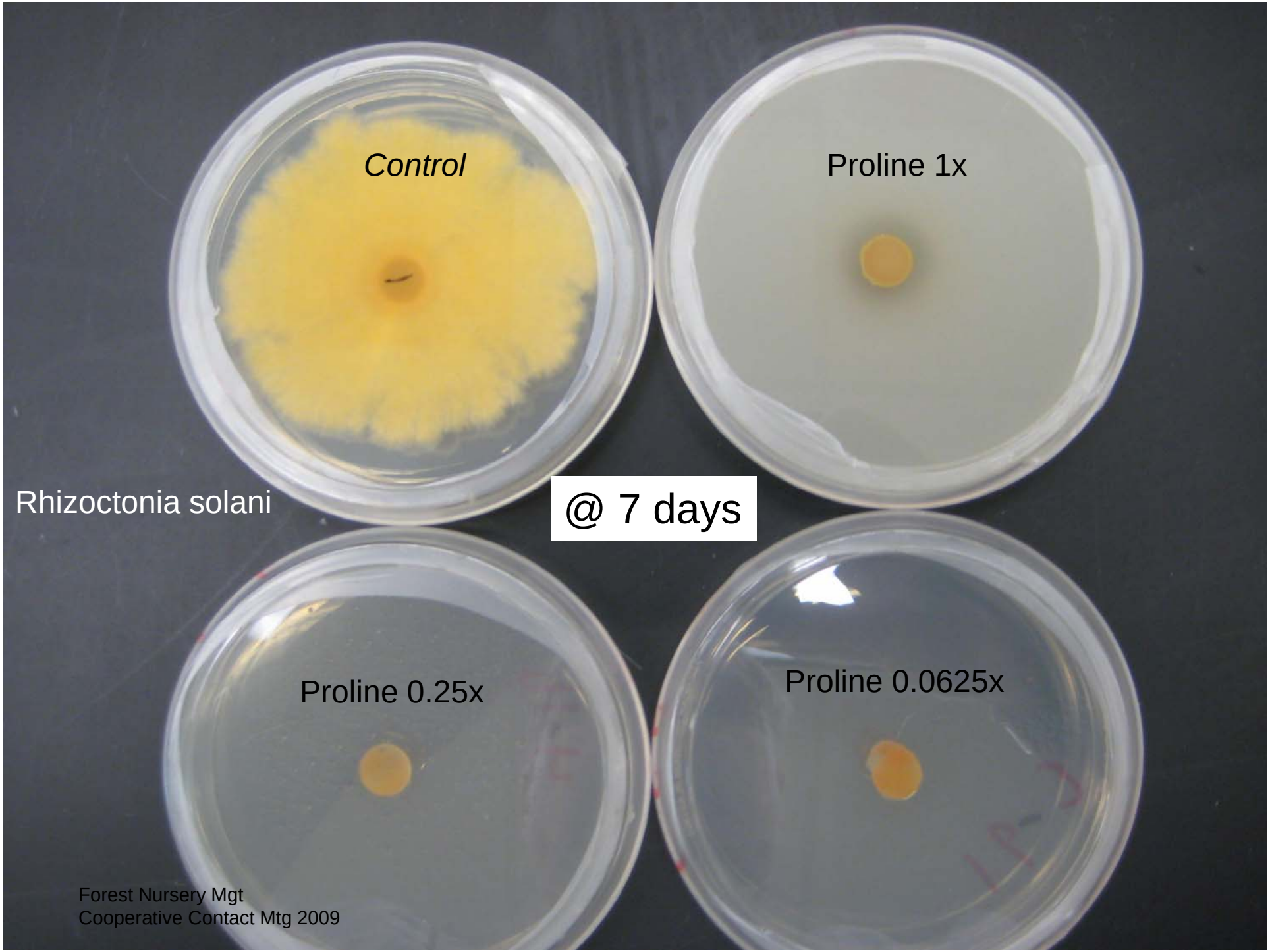
Control
Proline 1x
Rhizoctonia solani
@ 7 days
Proline 0.25x
Proline 0.0625x

When plug is placed back on unamended media – regrowth occurred

Proline + *Rhizoctonia* = Fungistatic

Proline Registration Efforts

- Encouraged by test results
- Supported by Bayer CropScience - even though it is a minor crop/no profit.
- In Nov. 2008 Bayer indicated they would support our effort to obtain a 24(c) label in 6 states for pitch canker and *Rhizoctonia* foliar blight.
- We wanted an additional year of research for fusiform rust before requesting a label.
- However……

Proline Registration Efforts

- As of mid-March 2009 - 5 of the 6 states had approved the request for a 24(c) label.

- Then in late March……

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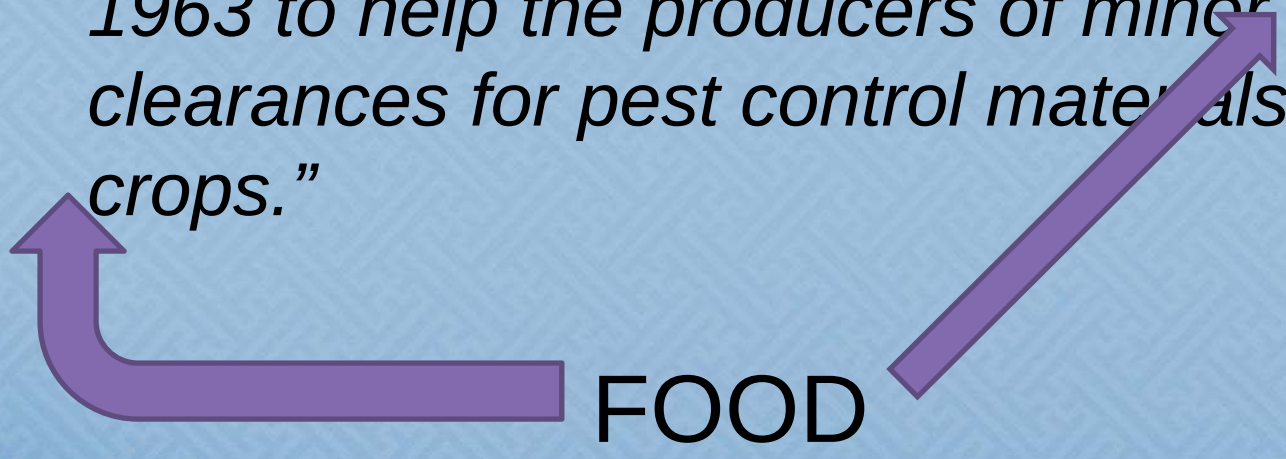
Proline Registration Efforts

- Several sources suggested we approach IR-4.
- *“IR-4 is the "minor use pesticides" program. It is a federal cooperative program established in 1963 to help the producers of minor crops obtain clearances for pest control materials on minor crops.”*



Proline Registration Efforts

- So as of today, after consulting with Bayer CropScience, we will be pursuing a Section 18 label for control of Pitch Canker.
- If and when Bayleton is taken off the market, we will also file a Section 18 label request.

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