Southern Forest
Nursery Management Cooperative
Fall 2008

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Director's Report

A lot has happened since the release of the Re-eligibility Decision (RED) for soil fumigants used in seedling production. The Comment Period, with respect to EPA's deadline on the proposed rules, is October 30th. I want to thank all of you who supplied me with information so that I could respond to EPA. Despite the distraction of the RED and all it entails, I hope that your seedlings are ready to be lifted, outplanted and that you have another productive growing season under your belt. We will continue to work on the MBr issue both CUE and QPS, re-registration of pesticides and evaluation of alternative fumigants, fungicides and herbicides.

Membership

I was given notice by Harry Vanderveer (Texas Forestry Commission) that they would not be renewing their membership next fiscal year. I will miss Harry at the Contact and Advisory Meetings, as the TFC has been a long-time cooperator. Bill Carey and I had a number of research trials that covered hardwoods, fumigation, and other nursery research that was beneficial to seedling producers in Texas. With Texas dropping the membership, the Nursery Cooperative has 16 full members.

Advisory Meeting

The Advisory meeting is scheduled for Thursday and Friday, November 6 & 7, 2008 at the School of Forestry and Wildlife Building at 602 Duncan Drive. We will begin the meeting after lunch on Thursday and adjourn around noon on Friday. We will set up the meeting using video conferencing for those who may not want to travel to Auburn. If you would like this option, call Elizabeth Bowersock at 334.844.1012 and she will let you know what you need to access the meeting. Place these days on your calendar and more information will be available shortly.

Nursery Cooperative Short Course

The 2008 Nursery Management Short Course was held in Auburn the first week in September. Thirty participants learned about irrigation, soil/plant/water relationships, insect and disease control, fumigation and sampling procedures. Based on comments from the participants, the course was well received and covered the right topics. We appreciate this kind of feedback and would also like to hear of any ideas or needs for future Short Courses.

Contact Meeting

The 2007 Nursery Cooperative Contact meeting was held on July 21, 2008 in Asheville, North Carolina in conjunction with the Southern Forest Nursery Association Biennial Meeting. The Nursery Cooperative's portion of the meeting was attended by 54 Cooperative members. For those who were unable to attend, we have posted all the presentations on the Nursery Cooperative's website for you to access. Next year's Contact Meeting will be held in Pensacola, FL / Mobile, AL region mid June – mid July. We are currently trying to schedule the Contact meeting around

Inside this issue...

the Southwide Forest Disease Workshop (SWFDW) and the International Union of Forestry Research Organizations' (IUFRO) Forest Nursery Meeting. Both of these meetings are looking at June / July as their meeting times as well. As soon as I get a confirmation of their meetings, we will schedule the Contact Meeting. We are currently working on study plans and research plots for the nursery tour with Sam Campbell (Molpus Timberlands) at their Elberta, AL nursery as part of the Atlantic Region USDA Areawide MBr Alternative trials. We will have an indoor session with Cooperative staff and selected invited speakers presenting their most recent research findings. More details will be forthcoming with the Spring 2009 Newsletter.

Pesticide News

MBr Issues

The 2008 CUE application (for 2010 MBr use) was submitted to EPA in early July. The Agency will include it in their report to the State Department and a subsequent request for MBr will be made to the UN. The final amount awarded to Critical Users will be determined by the UN in November 2008. While the amount awarded to forest seedling users has remained constant (approximately 120,000 lbs) over the past 5 years (Figure 1), the total amount of MBr awarded to all users has decreased (Figure 2). The result has been an increase in price for those nurseries that use MBr from CUE sources (Figure 3).

One of the more relevant topics under the Pesticide Heading is the "Risk Mitigation Options to Address Bystander and Occupational Exposures from Soil Fumigant Applications Fumigant Mitigation." Throughout the entire 18 month re-registration process, EPA was looking at steps and methods that "lower the exposure risk" to users, growers and bystanders. These rules will affect the use of soil fumigants (Methyl Bromide, 1,3-Dichloropropene (telone), Metam-sodium/potassium, Dazomet/Basamid, Chloropicrin and Iodomethane).

The final rule was published on July 17, 2008 and I've pretty much spent the past 6 weeks working on nothing but RED and Risk Mitigation to a point of neglecting

> "Our circumstances answer to our expectations and the demand of our natures."
> ~ Henry David Thoreau

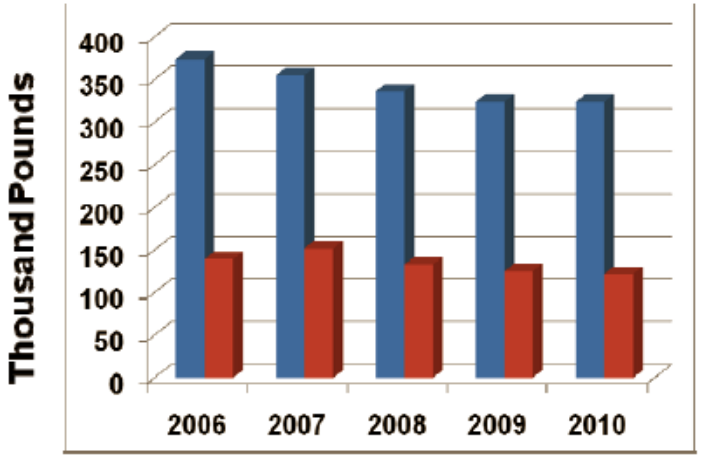

Figure 1. MBr requested by Forest Tree Nurseries throughout the U.S. (tall blue bars) and MBr Nominated (short red bars) by EPA for UN approval.

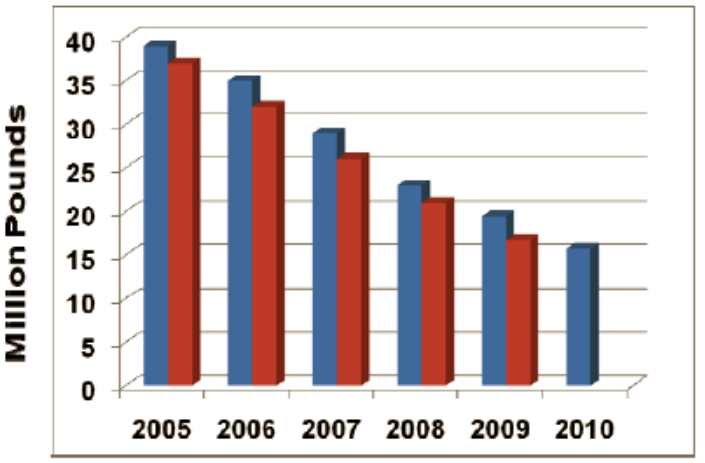

Figure 2. Methyl bromide nominated by EPA and State Department (taller blue bars) and MBr approved by UN (smaller red bars). The amount approved by the UN for 2010 will not be known until November 2008. The available MBr for all users has decreased from 37 million lbs in 2005 to 15 million lbs in 2009.

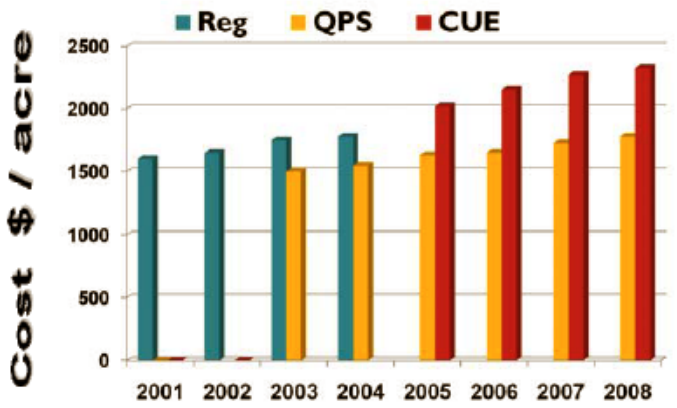

Figure 3. Relative cost per acre of Methyl Bromide by source. Source = Reg (prior to 2005 phase out), QPS – Quarantine Pre-shipment and CUE – Critical Use Exemption.

my other paid duties at the School of Forestry and Wildlife Sciences. For those that sent comments to EPA, I thank you for taking the time out of your schedule to do so. The deadline for comments is October 30th. These comments will be collected and EPA will come up with a rule/law that indicates how, where and when you will be able to use these fumigants.

QPS

Only TN and VA remain unable to use MBr in forest-tree nurseries under the QPS requirements for both intra-state and inter-state seedling production. Tennessee was waiting for the North Carolina State Plant Board to adopt their rules after which, TN would move. North Carolina's rule was finalized in 2007, but TN has yet to put forth their rules.

Virginia has the support of their state plant board, but the rule needs to be put on the "Top 10" list forwarded to their legislative bodies for approval.

Tom Starkey and I will continue to press the issue with those two states so that they can use MBr in their nurseries under the QPS guidelines.

Research

Bayleton Replacement: One step closer to registration?

Tom Starkey

Once again, the question must be asked: "What is the single most important chemical that I use in my nursery? If I didn't have this chemical, I could not grow trees." What would be your answer? If methyl bromide was your answer – you are wrong (although if things continue with EPA, you may get a chance to try). If Goal® was your answer – strike two. What would your loblolly seedlings look like without Bayleton®? How much of a market is there for seedlings with knots on the stems? Can you name an alternative for Bayleton®? We have not fully appreciated the importance of Bayleton® in our arsenal of chemicals. Here we are again looking at another round of fungicides. Last year's results are beginning to focus on one particlar chemical.

Bayleton® is always included in our studies as well as an untreated control. This year, at the suggestion of a Nursery Cooperative member, we are looking at the alternatives on both loblolly and slash pine. Last year we had promising results with Provost 433 SC® from Bayer Cropscience. As indicated in Table 1, Provost 433 SC® contains two fungicides. In previous trials we tested tubconazole (Folicur®) alone. It was not as effective as Bayleton® in controlling fusiform rust.

Table 1. List of the fungicides we are tested in 2008.

Fungicide	Manufacturer	Active Ingredient	Chemical Class
Bayleton®	Bayer Cropscience	Triadimefon 50%	Triazole
Provost 433 SC®	Bayer Cropscience	Prothioconazole 12.9%	Triazolinthiones
		Tebuconazole 25.8%	Triazole
Proline 480 SC®	Bayer Cropscience	Prothioconazole 41.0%	Triazolinthiones

Table 2. Seed treatment rates, germination and mean percent infection.

		Loblolly	Slash
Seed Treatment	% Germination	3-Month Mean	3-Month Mean
Fungicides	Lob/Slash	% Infection	% Infection
Check	95% / 93%	3.1% a	36.9% a
Bayleton®	92% / 96%	0.0% b	1.0% b
Provost 433 SC®	96% / 93%	0.0% b	0.0% b
Proline 480 SC®	96% / 93%	1.0% ab	0.0% b
	lsd	*2.9%*	*4.3%*

Table 3. Foliar treatment rates and mean percent infection.

		Loblolly	Slash
Foliar Treatment		3-Month Mean	3-Month Mean
Fungicides	Foliar Rate[1]	% Infection	% Infection
Check (water)	N/A	6.9% a	39.6% a
Bayleton®	8 oz/a	2.5% ab	16.9% b
Provost 433 SC®	8.5 fl oz/a	1.8% b	5.9% c
Proline 480 SC®	5 fl oz/a	4.3% ab	12.0% bc
	lsd	*4.4%*	*7.8%*
USFS Check Seedlings		32%	65%

[1] Based upon 30 gal of water /acre

Our Bayer Cropscience contact, David Hunt, suggested we test another formulation of prothioconazole, Proline 480 SC®, which has had good performance in controlling peanut diseases.

Seed Application. Loblolly and slash pine seed were stratified for 4 and 3 wks respectively, after which they were treated prior to sowing (Table 2). Bayleton® was the only dry formulation fungicide tested this year. After the seed was moistened in a seed tumbler,

Bayleton® was added at the rate of 2 oz/50 lbs of seed. For all other fungicides, 1 ml of the fungicide was slowly added to the dry seed in the seed tumbler. The seed remained in the tumbler until dry. On April 16, 2008 seed were treated with either Proline 480 SC®, Provost 433 SC®, as well as a Bayleton DF® check and non-treated seed for both positive and negative controls. Treated seed were double sown to Ray-Leach containers and then thinned to one seedling per cell as they germinated. Eight replications of twenty seedlings each were considered the treatment unit. The percent germination of treated seed was recorded.

Foliar Application. Loblolly and slash pine seed were stratified for 4 and 3 wks respectively after which they were double sown to Ray-Leach containers on March 10, 2008. Containers were thinned to one seedling per container and then randomly assigned fungicidal treatments. Eight replications of twenty seedlings each were considered the treatment unit. The foliar treatments contained either Proline 480 SC®, Provost 433 SC®, Bayleton DF® check and non-treated seedlings for both positive and negative controls. Application rates for each fungicide are listed in Table 3. On May, 5 2008, seven weeks post sowing, seedlings were treated with the fungicides at the Auburn University's Pesticide Research Facility. After treating seedlings they were returned to the greenhouse.

On May 6, 2008 foliar-treated and seed-treated seedlings were transported to the USDA Rust Screening Laboratory, Asheville, North Carolina. Seedlings were allowed to acclimate to the new growing conditions until May 14, 2008, when they were challenged with 25,000 spores/ml of *Cronartium quercum f.sp. fusiforme* using the laboratories inoculation protocols. Seedlings remained under the care of the Rust Lab for the duration of the growing season. On August 8, 2008 the seedlings were examined for swellings along the main stem which is an indication of infection. The results of this 3 month evaluation are presented in Table 2 and 3. In late October, 2008 a final evaluation will be made by the personnel at the Rust Lab. After this final evaluation the seedlings will be returned to Auburn University where height, RCD and seedling biomass will be measured.

20 Years Ago . . .

What were the concerns of the Forest Nursery Management Cooperative in the Fall 1988 Newsletter?

I was surprised when I went to my files and then to the web to find out that Fall 1988 was the first (and only) time since the start of the newsletters that we did not publish a Fall Newsletter. A bit of trivia for you old timers .... When the next newsletter was published (Spring 1989) there was a change in the Nursery Cooperative directorship. Who was the new director?

Results & Discussion

Germination Following Seed Treatment. The standard procedure with Bayleton® has been its use in the nursery as a seed treatment in conjunction with foliar sprays early in the season during the susceptible time for rust. The rates of Provost® and Proline® used in this study did not affect seed germination.

Rust Control. The three month test results for Provost® and Proline® are encouraging. The seed treatment was applied 4 weeks before being challenged with 25,000 spores/ml of *Cronartium quercum f.sp. fusiforme* at the Rust Lab. The amount of rust recorded after 3 months was 1% and indicated a long residual efficacy between treatment and challenging with the fungus (4 weeks). Both Provost® and Proline® provided foliar control similar to Bayleton® on loblolly. Slash pine had a higher incidence of rust than loblolly as well as on the check seedlings inoculated by the Rust Lab (Table 3). On slash pine, Bayleton® and Proline® had 17% and 12% infection. The amount of infection is high and needs to be examined further. Some of the slash pine died at the Rust Lab due to pitch canker.

Ongoing Nursery Trials:

This year, two Nursery Cooperative members are testing Provost® and Proline® under operational conditions. We are grateful that Argorgen Super Tree Nursery in Shellman, GA and the Taylor Forest Nursery in Trenton SC agreed to test both of these fungicides. Each nursery has set aside 0.6 to 1 acre to test each chemical in an experiment. Fungicides were applied at label rate and time intervals suggested on the labels. The application of Provost® and Proline® coincided with the time period in which Bayleton is normally applied as a foliar spray. We will be collecting field data from these plots this fall and early winter.

Future Research:

If Proline® continues to control fusiform rust in the two field and 6-mo greenhouse trials, we will need to answer two questions next year. First, what is the time interval between sprays for these fungicides? Right now, we are using label recommendations of 2 weeks. Second, we also need to determine the lowest effective rate used as a seed treatment and still have rust control?

Pythium in Nursery Soils
Paul Jackson

Pythium is a common soil-borne pathogen found in nursery soils that has been linked to the disease known as "damping-off". This disease results in recently sown seed to either not germinate or new germinants to buckle (damp-off) at the hypocotyl area and die. *Pythium* is also known as a "fine feeder root disease", which infects feeder roots that are essential for water and nutrient absorption. Seedlings up to several weeks old remain susceptible to both damping-off and feeder root infection. Patches of stunted, chlorotic seedlings found throughout the nursery are a good sign that this fungus is present in the soil.

Depending on factors such as temperature and soil moisture, the severity of disease or even the presence of *Pythium* can fluctuate from year to year. *Pythium* can lay dormant in soil for years. However, fungal spores are able to move throughout the soil profile and nursery bed after heavy rainfall or irrigation water. In addition, the use of machinery can cause areas of compaction, altering soil drainage and allowing the fungus to become active. Damping-off and feeder root rot can be controlled or prevented. Controlling irrigation frequencies and establishing a good drainage system are great ways to minimize desirable fungal conditions. Other methods to control these diseases include maintaining a low soil pH, avoiding the use of contaminated equipment, and periodic soil fumigation..

It has been noted that common nursery practices can cause *Pythium*-induced diseases to become chronic and develop conditions for these fungi to thrive. One such practice may be simply the lifting of bareroot seedlings at the end of the growing season. Roots can be stripped and microscopic wounds can develop from the process of lifting, especially if soil conditions are unfavorable. *Pythium* could use these wounds to infect seedling roots. If seedlings are then placed in cold storage for a few days to many weeks, the fungus could multiply in the cool, moist conditions.

It is widely known throughout the forest tree nursery industry that the survival of bareroot seedlings is poor after being cold stored in the fall, but storage is better during the winter months. Scientists have yet to find an answer to this mystery. In 1991, Stumpf and South eluded to the fact that rapid changes in root respiration or root carbohydrate levels could increase seedling susceptibility to damage by pathogenic fungi. Could it be possible that *Pythium* is more active in the soil during the fall months as levels of sugars or starches fluctuate in the seedling root system?

As a component to my seedling cold storage research, I am interested in knowing how prevalent or common *Pythium* species might be in the soils of our nurseries. To do this, I am asking for a small bit of your time. In late October and in January I will be mailing out a package to all of the nurseries in the SFNMC. In it you will find a box that holds soil samples, an instruction sheet, and a pre-paid postage label to return the sample to Auburn University. The instruction sheet will explain the procedure for collecting the soils in detail. I will be analyzing the soils for *Pythium* species, particularly *P. dimorphum* and *P. irregulare*, which have been shown to be pathogenic after exposure to seedlings and cold storage and in damping off, respectively. It would be interesting to find differences in *Pythium* presence between the fall and winter seasons.

Please feel free to contact me if you have any questions regarding my research or if there is a cold storage question I can attempt to answer or investigate. My email address is dpj0001@auburn.edu and phone number is (334) 844-8071. I am having fun working with the SFNMC and look forward to visiting with many of you soon.

2008 Area-Wide Demonstration of Alternatives for Methyl Bromide
Marietjie Quicke

As part of the South Atlantic Region Areawide Methyl bromide Alternative program funded by USDA – ARS, two additional large-scale fumigation trials were established for the 2008 growing season. These are at the South Carolina Forestry Commission Nursery in Trenton, SC (fall 2007) and at the ArborGen Nursery in Blenheim, SC (spring 2008). Methyl bromide and six alternative fumigants (Table 1) were shank injected and covered with 1 ml High Density Polyethylene Tarp (Cadillac Plastics Inc.) as a broadcast/flat tarp. At Trenton, SC a non-fumigated plot was also included. Each nursery sowed a single family of loblolly pine (*Pinus taeda*) and the seedlings are being managed using the nurseries standard operating practices.

At Trenton, SC, 5 acres out of a total 31 production acres were fumigated in November 2007 (Table 2) using a randomized complete block design. The treatments were replicated 5 times with each treatment 400 linear bed feet. At Blenheim, SC, 4.5 acres out of a total 77 production acres were fumigated in March 2008 (Table 2) using a randomized complete block design. The treatments were replicated 4 times with each treatment 280 linear bed feet.

Soil samples from each treated block were collected pre -sowing and mid-summer and were divided into two sub-samples. One sample was plated onto *Trichoderma*

selective media. The other sub-sample was examined for nematodes using the Nematode Laboratory at Auburn University. In addition to the two new trials in SC, seedling density counts were determined at all four nurseries (Jesup and Glennville, GA – 2nd year crop) at four weeks, at mid-summer, and prior to lifting. Seedlings from each of the plots will be collected in the fall for seedling quality measurements.

Results and Discussion: Seedling densities over the growing season for Trenton and Blenheim for each soil fumigant is shown in Figures 1 and 2 with the target densities for each nursery indicated by a red line.

The soil data at four weeks post-sowing indicates the levels of *Trichoderma* in all the soil fumigants tested. (Figure 3). The amount of *Trichoderma* relative to other soil fumigants is consistent with previous Forest Nursery Cooperative research showing that *Trichoderma* is sensitive to different soil treatments. Trichoderma is an important soil borne fungus necessary for proper growth of pine seedlings. The

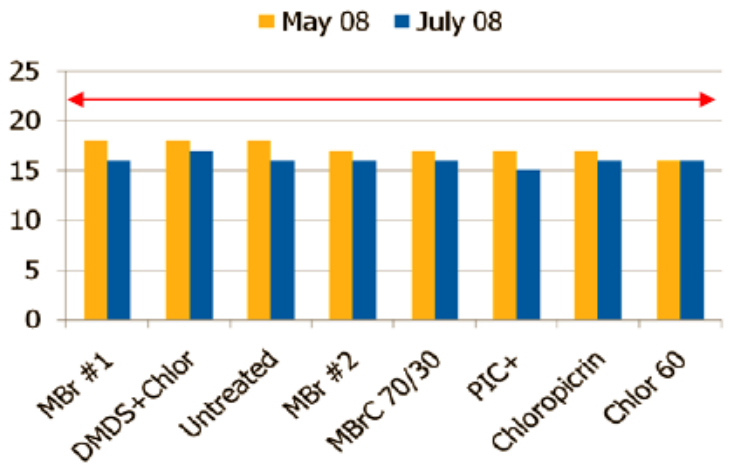

Figure 1. Seedling density, Trenton, SC. (Red line = Target 23

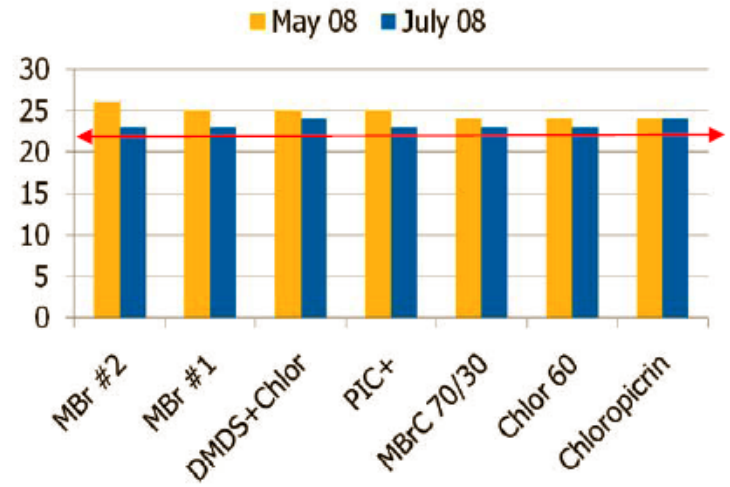

Figure 2. Seedling bed density, Blenheim, SC. (Red line = Target 22 trees/ft^2.)

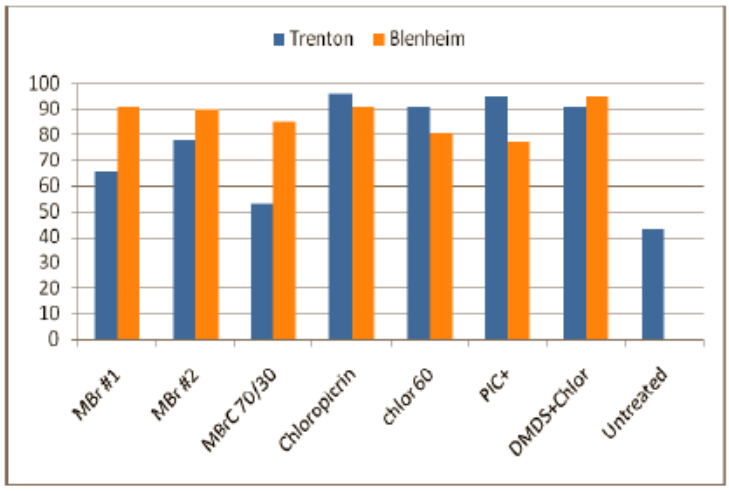

Figure 3. Percent *Trichoderma* 2008 pre-sowing

Gel Bags • A Word of Caution

If your first question to this title is, "What are Gel Bags?" , I would like to send you to the Nursery Cooperative web site. In the "Members Only" section you will find the PowerPoint presentation of this talk presented at the Contact Meeting in Asheville, NC.

Gel bags look like a tea bag that is filled polyacrylamide gel, similar to what many of you use at the time of lifting and spray on seedling roots. The intent is to place one of these bags in the planting hole of seedlings planted on adverse sites. In principle, the hydrogels are intended to absorb water from the soil which is then available to the seedling during the establishment phase. They are intended to increase seedling survival after outplanting.

At the Contact meeting, the results from two studies were reported and then some pertinent horticulture examples were discussed from the literature. All of these studies raised several questions related to polyacrylamide gel application which we hope to examine next year.

We know that the use of polyacrylamide/starch gels as a root spray/dip does provide protection to seedling roots from lifting to the planting hole. Placing gels on roots at the time of packing/lifting increases survival of seedlings exposed to the elements over those seedlings that did not get gels placed on their roots. Thus, root gels "protect" seedlings against poor handling practices before they are placed in the soil (Research Report 07-04). So, don't interpret this caution on the use of gels outside of what was presented at the Contact Meeting.

Our word of caution pertains to using these bags on sandy sites in drought conditions. Several of the literature references we found indicate that the uses of polyacrylamide gels as a soil amendment are detrimental to plant survival in sandy soils.

levels of *Trichoderma* in the DMDS + Chloropicrin treatment are encouraging since previous studies indicated that DMDS alone was detrimental to *Trichoderma* levels in the soil. The fumigation treatments that contain chloropicrin seem to be *Trichoderma* friendly.

One of the objectives of the USDA Areawide MBr alternative project is to test soil fumigants in large-scale plots using current seedling production systems. This should indentify alternatives to MBr that could be implemented in forest-tree nurseries. Data collected from these four trials (and data from Texas) indicate that the nursery soil type has a significant influence on the soil fumigants performance, on seedling characteristics and weed pressure. Cooperative Member nurseries should examine the soil fumigant and seedling performance and match the soil type and time of fumigation (spring / fall) to their systems. Many of the alternatives tested so far appear promising as alternatives to MBr.

Table 1. Fumigants and rates used in 2008 Area–wide demonstration plots, at Trenton & Blenheim, SC.

Fumigant	Rate	Components
MBr #1	400 lbs/a	98% MBr + 2% Chloropicrin
MBr #2*	235 lbs/a	98% MBr + 2% Chloropicrin
DMDS + Pic	74 gal/a (731 lb/a, Trenton, SC)	79% DMDS & 21% Chloropicrin
DMDS + Pic	70 gal/a (Blenheim, SC)	79% DMDS & 21% Chloropicrin
MBrC 70/30	400 lbs/a	70% MBr (98/2) & 30% Solvent A
Pic+	300 lbs/a	85% Chloropicrin + 15% Solvent A
Chloropicrin	300 lbs/a	100% Chloropicrin
Chlor 60	400 lbs/a	60% Chloropicrin & 40% 1,3-D

*This rate was used to examine the effects of lower MBr rates on the relative nematode levels over the cropping rotation.

Table 2. Trial information for each location.

	Trenton, SC	Blenheim, SC
Fumigation	2-Oct-07	3-Apr-08
Fumigation Type	Shank injected Broad-cast/flat tarp	Shank injected Broad-cast/flat tarp
Area in trial	5 acres	4.5 acres
Air temperature range	61 to 82°F	44° to 48°F
Wind speed	3 – 11 mph	5 – 11 mph
Soil moisture	5%	7%
Soil series	Wagram sand	Autryville sand
Plastic in place	10 days	7 days

Controlling Nematodes Between Fumigation-Year 2
Tom Starkey

Two years ago, at the Southern Forestry Nursery Association Biennial Conference in Tyler Texas, Michelle Cram, a plant pathologist with the US Forest Service in Athens, Georgia raised the questions "Have you noticed a problem the second year following fumigation?" and "Do you have to "push" those seedlings more than usual?" It struck a chord with several nursery managers within the Nursery Cooperative. However, when the Nursery Cooperative began to examine what was available to control nematodes during the second year we realized that there are no chemicals registered for treatment over pines after sowing.

Why are nematodes "becoming" a problem during the second year? Could it be due to the decrease in the amount of methyl bromide being used? Could it be due to less than optimum environmental conditions during fumigation? Could it be due to contamination by nursery equipment? There are probably other reasons, but the bottom line is that if nematodes are a problem; your choices of chemicals have been slim..

In late July, 2006 an area at the Glennville Regeneration Center in Georgia was identified as being 2nd year land with a stunt nematode problem (*Tylenchorhynchus sp.*). We put in an experiment to answer the following questions:

1. What nematicides can we apply on land currently in pine production that will not kill the pines?
2. What level of nematicides can be used to effectively reduce the nematode populations?
3. Will the seedling quality be affected as a result of the nematocide treatments?

The following treatments were used:

1. Control (no soil treatments)
2. Trilone II® (1,3-Dichloropropene) @ 5 gal/acre
3. Trilone II® (1,3- Dichloropropene) @ 7.5 gal/acre
4. Trilone II® (1,3- Dichloropropene) @ 10 gal/acre

5. MBC 70/30® (70% 98/2 Mbr/Chl & 30% solvent) @ 50 lbs/acre ai
6. MBC 70/30® (70% 98/2 Mbr/Chl & 30% solvent) @ 75 lbs/acre ai
7. MBC 70/30® (70% 98/2 Mbr/Chl & 30% solvent) @ 100 lbs/acre ai

At the end of this first study we reported that none of the chemical rates caused seedling injury. Both Trilone II and MBC 70/30 are known to control nematodes and a reduction in nematode levels was observed for each. We also realized that the Yetter coulter rig with five 36" coulters used to shank inject the chemicals was not what we needed in forest nurseries.

In early June of 2008 a 2nd year nursery section at the Glennville Regeneration Center in Georgia was identified as having nematodes (Stunt, *Tylenchorhynchus sp.*) This time, a lateral root pruner from the nursery was sent to Hendrix & Dail who modified the pruner and added a removable injection rig that allowed a more precise injection of the materials between the seedling drills.

On June 26, 2008 another trial to examine nematode control during the second growing season was installed at the Glennville nursery. This timing was approximately 10-wk post sowing with a soil temperature of 74°F, air temperature of 70° to 92 ° F and wind speed of 2 to 11 mph. The treatments in this trial were:

1. Control
2. Trilone II® (1,3- Dichloropropene) @ 7.5 gal/acre
3. Trilone II® (1,3- Dichloropropene) @ 10 gal/acre
4. DMDS (100% Dimethyl Disulfide) @ 300 lb/acre
5. DMDS (100% Dimethyl Disulfide) @ 400 lb/acre

The study was designed as randomized complete block with five replications. After the study was put in, ¼" water seal applied immediately and again in the afternoon.

Both Trilone II and DMDS are known to control nematodes. As a result of the 2006 study, seedling damage from Trilone II was not expected. However, there was no data / reports of DMDS being applied in between seedling drills. Nematode levels were determined prior to the soil treatments and then again four weeks after treatment. Seedling quality was also determined for each treatment.

Both chemicals reduced nematode levels following injection. No seedling injury was observed with any of the Trilone II treatments. This is similar to the 2006 trial, however, the highest rate of DMDS caused significant seedling death and injury. While the low rate of DMDS (300 lb/a) caused less death and injury (than the High DMDS), the amount of injury was more than a nursery manager could accept. The complete analysis of the data will be presented at the 2008 Advisory meeting.

Since EPA considers DMDS as an alternative soil fumigant to methyl bromide, it may be worth repeating this study with lower levels of DMDS to see where seedling injury and nematode death stop. DMDS is also a broader spectrum soil fumigant than 1, 3-D. Details of the study and pictures of the modified root pruner can be seen in the PowerPoint Presentation from this year's Contact Meeting by visiting the Nursery Cooperative web site.

Pitch Canker - Proline® Fungicide Studies

Tom Starkey

Pitch canker, caused by the fungus *Fusarium circinatum,* can cause significant seedling mortality in nurseries. Nursery losses have been reported on loblolly, slash, longleaf, shortleaf and Virginia pine. The fungus is considered the most threatening disease in South African nurseries. There are no fungicides registered for the control of pitch canker on either seed or seedlings.

In our attempt to find an alternative to Bayleton® we have been testing a fungicide manufactured by Bayer Cropscience, Proline 480 SC®. Proline® represents a new class of fungicides with many appealing chemical and physical characteristics. It is currently registered on a variety of crops including peanuts, barley, dry beans and wheat.

This year we have been looking at the efficacy of Proline® on the pitch canker fungus. Two of these studies are reported in this newsletter.

Study 1: Efficacy of Proline® in the Laboratory. Two fungicides, Proline® and Pagaent® (BASF) were evaluated to determine if *Fusarium circinatum* was able to grow on agar media amended with three a.i. levels. Both fungicide labels list report activity against *Fusarium* spp. The active ingredient and each fungicide rate used in the study are shown in Table 1.

Table 1 Fungicides, active ingredients and rates used in study

Fungicide	Active Ingredient	Rate
Proline 480 SC®	Prothioconazole – 41%	1x – 5 fl oz/a based upon 30 g water/a 0.5x – 2.5 fl oz/a 0.25x – 1.25 fl oz/a
Pagaent®	Pyraclostrobin 12.8% Boscalid 25.2%	1x – 14 oz/100 gal 0.5x – 7 oz 0.25 – 3.5 oz

Potato Dextrose Agar (Difco PDA) was amended with each fungicide rate after autoclaving and just before pouring the plates. There were 20 plates of each fungicide rate plus 20 non-amended PDA plates as a control. A #4 cork borer (~8mm) plug of *Fusarium circinatum* from a two week old culture was placed at the center of each plate. The radial growth of the fungus was measured over a period of 10 days. To determine if the treatments were fungicidal (killed the fungus) or fungistatic (stopped fungal growth), 11 days after placing onto the media, the agar plugs within each treatment were removed from the amended agar media onto non-amended media. Fungal growth was recorded for five days.

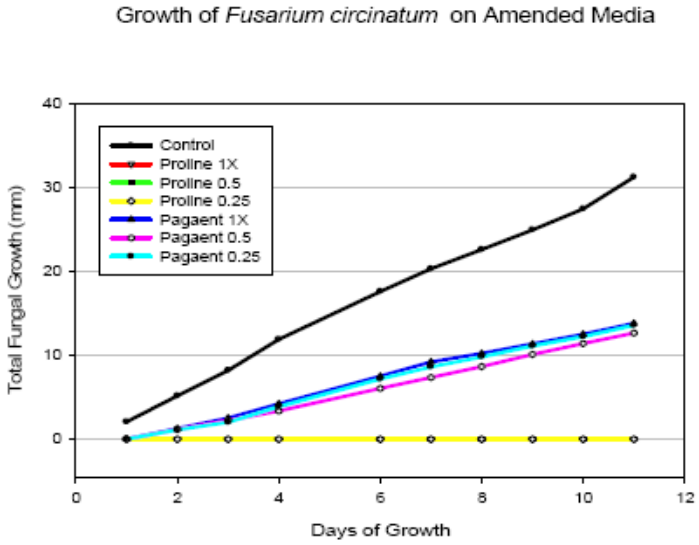

Figure 1. Radial growth of *Fusarium circinatum* on fungicide amended and non-amended agar.

Study 1 Results and Discussion: The radial growth for each of the seven treatments is shown in Figure 1. Fungal growth did not occur on any of the Proline® amended PDA plates for any concentration examined for the 11 day Trial. All three rates of Proline® are indicated as the yellow line at -0 mm. On some Proline® plates the fungus grew from the original plug for several mm, but never touched the amended PDA. The appearance was that of a mushroom cap suspended over the soil. *Fusarium circinatum* was inhibited but able to grow on all Pageant® concentrations. The levels of Pageant® are the three lines below the Control line, respectively. There were no significant differences between the concentrations of Pagaent®. Fungal growth on the control plates was significantly greater than either Pagaent® or Proline®.

After 11 days, the plugs were removed from the amended media and put onto non-amended agar media. None of the agar plugs from the Proline® amended plates resumed fungal growth when returned to non-amended agar indicating that Proline® was fungicidal. However, agar plugs from the Pagaent® amended media resumed growth on the unamended agar indicating that Pagaent® was fungistatic.

Table 2. Greenhouse Pitch Canker Study treatments and Proline Rate

	Treatment	Spray Rate
1	Fungal plug , no Proline®	0
2	Fungal plug , Proline®	5.5 Fl oz/a
3	No fungal plug , no Proline®	0
4	No fungal plug Proline®	5.5 Fl oz/a

During these *Fusarium circinatum* trials, we were wondering if the fungicide Bayleton® (used as a rust control fungi) had any effect on the fungus responsible for pitch canker. Thus, a small agar-amended study was repeated as described above that used Bayleton® at label rate and one half label rate added to the media. In this trial, *Fusarium circinatum* grew on the Bayleton®-amended plates at a similar rate to the Pagaent®. Therefore Bayleton® was fungistatic to *Fusarium circinatum* and not fungicidal, and would have some, but limited effect against the fungus.

Study 2: Efficay of Proline on Longleaf pine in the Greenhouse: Longleaf seed from a family known to have had pitch canker in the past was stratified for 10 days and sown in the greenhouse. To ensure disease and increase fungal pressure on the seedlings, an 8 mm agar plug from a stock culture of *Fusarium circinatum* was added to ½ of the container cavities at the time of sowing. There were 20 container sets, each with 20 cavities for each treatment. The treatment and spray rate of Proline® are described in Table 2.

Following sowing, treatments #2 and #4 were sprayed with Proline®. These treatments were sprayed every two weeks throughout the study. All cavities were covered with a thin layer of course perlite. Seedling counts were measured weekly for four weeks following germination and then one time per month until October 2008. Samples of dead seedlings were taken to the laboratory to confirm the presence of *Fusarium circinatum*. Dead seedlings from treatment #1 and #3 tested positive for the fungus.

Study 2. Results and Discussion: The percent cavity fill by treatment for the longleaf pine is shown in Figure 2. The percentage for no fungal plug and no Proline® treatment is what a nursery sowing this seed would expect to obtain. By week 11, the, no fungal plug with Proline® treatment, had 10% better cavity fill. The same relationship held with cavities that had a fungal plug added, for example, cavities with a fungal plug

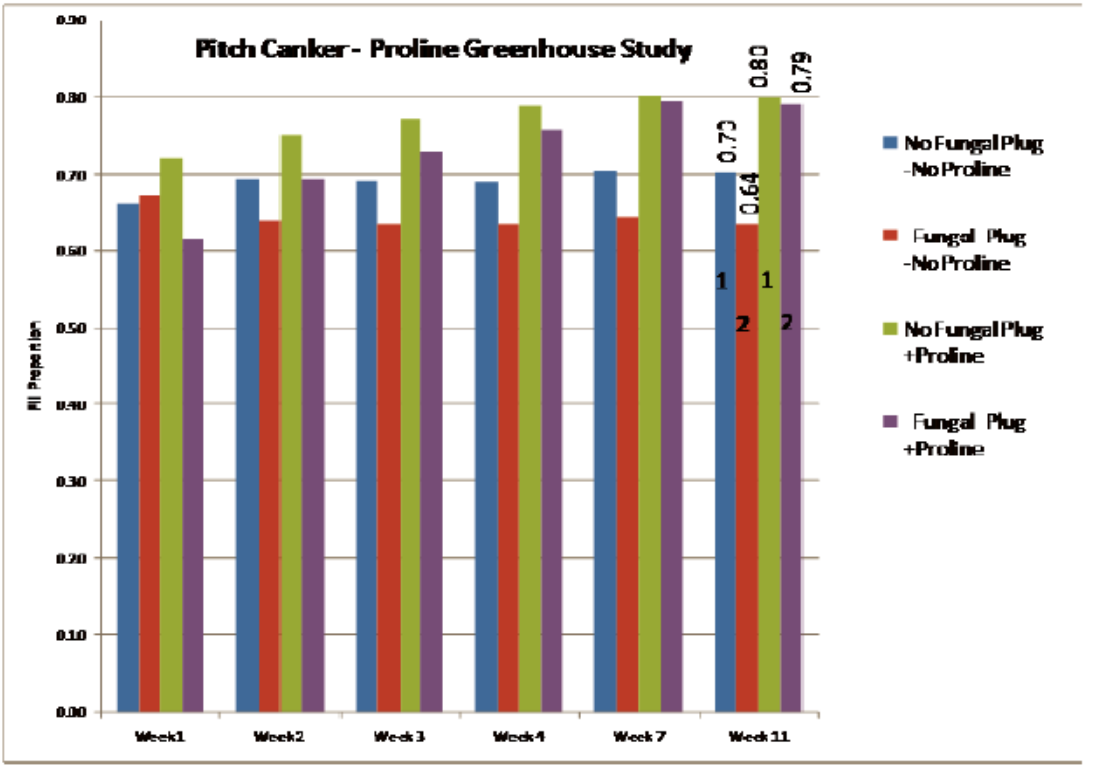

Figure 2. Fill percentage of treatments sprayed with Proline®.

added and no Proline® had 64% fill at week 11 which was significantly less than cavities with no fungal plug and no Proline®. Cavities with a fungal plug and Proline® had 15% greater fill percentage than without Proline®.

The results of both the laboratory and greenhouse tests examining the effects of Proline® on *Fusarium circinatum* provide an optimistic outlook on the possibility of finding a fungicide to control pitch canker in the nursery.

Two nurseries have been applying Proline® this season to control pitch canker. We hope to have further data to report at the November Advisory meeting.

David's Den

More Warm Temperatures & More Freeze Injury

This year we received more reports of freeze injury to loblolly and slash pine seedlings. Freeze injury to roots occurred this time from Arkansas to Georgia. As in the past, areas affected were confined to USDA hardiness zones 8a and 7b. The major freeze event occurred in early winter on Jan. 2-4, 2008. Temperatures in late December were above 70°F with nighttime temperatures above 60°F at some locations. In early January, temperatures dropped to 16-18°F. In several cases, newly planted seedlings died soon after planting.

Tolerance of container-grown longleaf pine to a freezing temperatures

Bill Pickens (NC Division of Forest Resources) conducted an interesting date of planting study in the fall of 2000. Five hundred containerized longleaf seedlings were lifted and put into storage the first week in October and one hundred seedlings were outplanted every two weeks. Seedling survival was 68% to 70% if planted before November 3 but survival was 20% or less if they were planted after November 3rd. There was a 23 °F freeze on November 22nd. Seedlings outplanted just 6 days before the freeze (on November 16) had only 15% survival, while seedlings planted on November 2 had 69% survival. Both sets of seedlings were exposed to the freezing temperatures and both were later exposed to a 15 °F freeze in December. However, those planted about 3 weeks before the freeze faired better than those planted only a week before the freeze. We suspect that seedlings allowed to acclimate naturally in the field for 3 weeks or more are better able to tolerate a hard freeze.

David's Big Mistake

Back in 1982 when I was younger and less experienced, I estimated the number of chilling hours (0-8 C) required to release the dormancy of loblolly pine buds. From daily maximum and minimum temperatures recorded at the airport at Hot Springs, AR, I estimated 403 chilling hours occurred from October 1 to December 19th, 1977. My big mistake was assuming this "magic" number could be used to determine when any loblolly pine seedling could be safely stored for a month or two in a cooler. My blunder resulted because instead of taking the time required to follow the scientific method, I relied only on intuition. As a result, the 400 number has been used at many nurseries to formulate a policy on lifting-date. As many nursery managers know, it now has become a dogma that is difficult to eliminate.

Fortunately, I eventually followed the scientific method. A number of date-of-lifting/storage studies have been conducted by the Coop. As a result, I no longer say that chilling is required before pine seedlings can be operationally stored for a month. In fact, we are still trying to understand the main reasons why early lifted seedlings go bad in storage. In some cases,

treating roots with fungicides have improved the storability of bareroot stock. Although chilling increases freeze tolerance and does affect bud dormancy, chilling hours are not the main factor that regulates when container-grown pine seedlings can be stored for a month. In years with warm autumns, delaying lifting based on this made-up number might result in a loss of seedling sales.

> "The real voyage of discovery consists of not in seeking new landscapes but in having new eyes."
> ~ Marcel Proust

EPA Will Increase Seedling Costs

According to EPA, the new fumigation rules will result in "some combination of more trips to fumigate the field, use of more expensive high barrier film, delays in planting due to longer fumigation operations, and more trips to the field for planting and other operations if fumigating in smaller blocks results in staggered operations. Some of these costs could be substantial." Currently, the retail price of a bareroot loblolly pine seedling might be 5 cents while the cost of a container-grown seedling might be 12 cents. Some bareroot nurseries might close if they are located too close to new housing developments. In some cases, nursery managers might decide to grow all their seedlings in containers. When this occurs, the cost of a pine seeding might increase by 140%.

The total economic effects of the new regulations are not yet known but the cost of soil fumigation could increase by $3,000 per acre (assuming soil fumigation companies are able to remain in business under the new regulations). This might raise the price of seedlings by 10% but at some nurseries, a loss in seedling production would have a much greater impact. In some cases, diseases and nematodes in non-fumigated soil might decrease crop value by 10 to 25%. If seedling production is decreased by 25%, then seedling price might increase by 33%.

Leadership Development

Give Your Best, No Matter What
Tom Starkey

Just recently, as I was reading our local newspaper, an editorial titled "Give your best, no matter what" caught my eye. As I read it I found myself asking the question: *"I've heard of the Ten Commandments, but what are the Paradoxical Commandments?"* Maybe the best place to start is with a definition. According to Webster's Dictionary, a paradox is "a seemingly contradictory statement that may nonetheless be true." A commandment is an authoritative directive. Therefore, a Paradoxical Commandment is an authoritative direction to do something that may be contradictory, but may nonetheless be true.

The Paradoxical Commandments were written by Kent Keith in 1968 while he was a sophomore at Harvard University. Since that time, these commandments have taken on a life of their own; appearing in obscure locations and in various forms. However the overall theme is valuable – do what is right, good and true, all without the expectation of a reward.

The Paradoxical Commandments

1. People are illogical, unreasonable, and self-centered.
   Love them anyway.
2. If you do good, people will accuse you of selfish, ulterior motives.
   Do good anyway.
3. If you are successful, you will win false friends and true enemies.
   Succeed anyway.
4. The good you do today, will be forgotten tomorrow.
   Do good anyway.
5. Honesty and frankness make you vulnerable.
   Be honest and frank anyway.
6. The biggest men and women with the biggest ideas can be shot down by the smallest men and women with the smallest minds.
   Think big anyway.
7. People favor underdogs, but follow only top dogs.
   Fight for a few underdogs anyway.
8. What you spend years building may be destroyed overnight.
   Build anyway.

9. People really need help, but may attack you if you do help them.
   Help people anyway.

10. Give the world the best you have and you'll get kicked in the teeth.
    Give the world the best you have anyway.

Nursery Technology 101

How well do you know your pesticide formulations?
Tom Starkey

____ a. Dry preparation which contains 15% to 95% active ingredient and must be mixed with water to form a suspension for application.
____ b. Small amount of pesticide or combination of pesticides that is driven through a fine opening by a gas under pressure.
____ c. Dry preparation which contains 15% to 95% active ingredient; dissolves in water to form a solution.
____ d. Low-concentration solution of pesticides: usually in an oil solution formulated especially for use in fog generators.
____ e. Pesticide in the form of either a poisonous gas or liquid which becomes a gas when applied.
____ f. Finely ground dry mixture combining a small amount of pesticide with an inert carrier such as talc, clay or volcanic ash.
____ g. Very finely ground solid material which is suspended in a liquid: usually contains high concentration of active ingredient and must be mixed with water for application.
____ h. Food or other substance mixed with a pesticide that will attract and be eaten by pests and cause their death.
____ i. Dry, ready to use mixture of a small amount of pesticide and inert carriers. All particles are larger than dust particles.
____ j. Solution which contains almost pure active ingredient; usually used without dilution.
____ k. Solution which contains a high concentration of active ingredient which can be mixed with water or oil, forms a milky solution when added to water.

1. Aerosol	2. Dust	3. Poisonous bait	4. Granular
5. Emulsifiable conc.	6. Ultra Low volume concentrate	7. Flowable	8. Wettable Powder
9. Soluble Powder	10. Fumigant		

(Answers are on the web site in the Members Only section!)

An Introduction...

Hello! My name is Jill Breeden and I am a new graduate student at Auburn University. I have had the good fortune to work in various fields which enabled me to gain and appreciate a broad spectrum of experiences. I have worked for an Herb and Spice company, a specialized Veterinary Diagnostic laboratory, and as a Naturalist to name a few. My more recent and relevant work experience was as a research technician for the USDA-ARS. I worked with fungal pathogens that affected wheat. I then worked for the Hardwood Tree Improvement and Regeneration Center doing tissue culture work with hardwoods. I found I loved working with trees and still had a passion for pathology so naturally I needed to become a Forest Pathologist. Take that one step further and my ultimate goal is to become a Molecular Forest Pathologist! I am under the direction of Dr. Scott Enebak who is giving me the wonderful opportunity to make it happen! My main project is producing Phytophthora-free chestnut seedlings in forest nurseries. I have a second project underway working with Butternut in a host/non-host resistance project. I hope to start a small third project which will involve looking at ozone-induced and pathogen-induced defense responses in plants and their pathways. I have 2 wonderful grown sons, a two year old grandson and another grandchild on the way! Life is good!!!

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Fax	334.844.4873

Newsletter Supplement

Pitch Canker - Proline® Fungicide Studies

Tom Starkey

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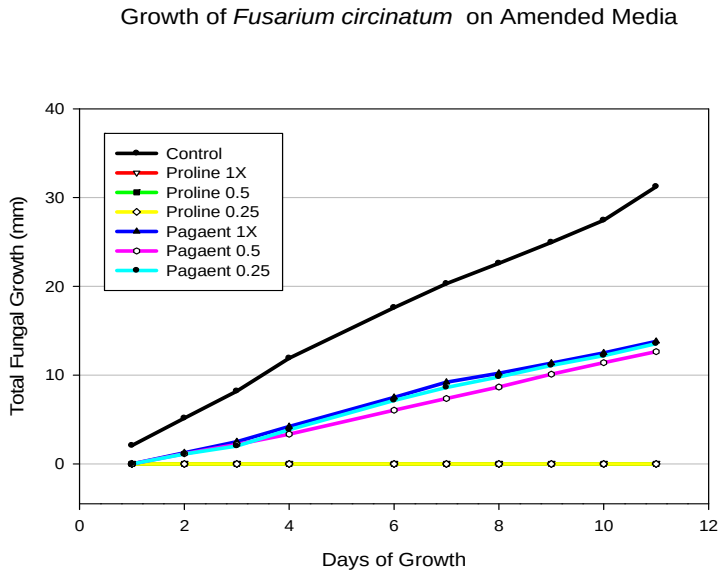

Figure 1. Radial growth of *Fusarium circinatum* on fungicide amended and non-amended agar.

After 11 days, the plugs were removed from the amended media and put onto non-amended agar media. This step was taken to determine if the fungicide was fungicidal (able to kill the fungus) or fungistatic (inhibited the growth). None of the agar plugs from the Proline® amended plates resumed fungal growth when returned to non-amended agar indicating that Proline® was fungicidal. However, agar plugs from the Pagaent® amended media did resume growth on the unamended agar indicating that Pagaent® was fungistatic.

As we were doing these *Fusarium circinatum* trials, we were wondering if the fungicide Bayleton (used as a rust control fungi) had any effect on the fungus responsible for pitch canker. Thus, a small agar-amended study was repeated as described above that used Bayleton® at label rate and one half label rate added to the agar media. In this trial, the pitch canker fungus *Fusarium circinatum* grew on the Bayleton amended plates at a similar rate to the Pagaent®. Therefore Bayleton® was fungistatic to *Fusarium circinatum* and not fungicidal, and would have some, but limited affect against the fungus.

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increase fungal pressure, an 8 mm agar plug from a two week old stock culture of *Fusarium circinatum* was added to ½ of the container cavities at the time of sowing. There were 20 container sets, each with 20 cavities for each treatment. The treatment and spray rate of Proline® are described in Table 2.

Table 2. Greenhouse Pitch Canker Study treatments and Proline Rate

	Treatment	Spray Rate
1	Fungal plug , no Proline®	0
2	Fungal plug , Proline®	5.5 Fl oz/a
3	No fungal plug , no Proline®	0
4	No fungal plug Proline®	5.5 Fl oz/a

Following sowing and the addition of a fungal plug, treatments #2 and #4 were sprayed with Proline®. These treatments were sprayed every two weeks throughout the study. All cavities were covered with a thin layer of course perlite. Seedling counts were measured weekly for four weeks following germination and then one time per month until Oct. 2008. Samples of dead seedlings were taken to the laboratory to confirm the presence of *Fusarium circinatum.* Dead seedlings from treatment #1 and #3 tested positive for the fungus.

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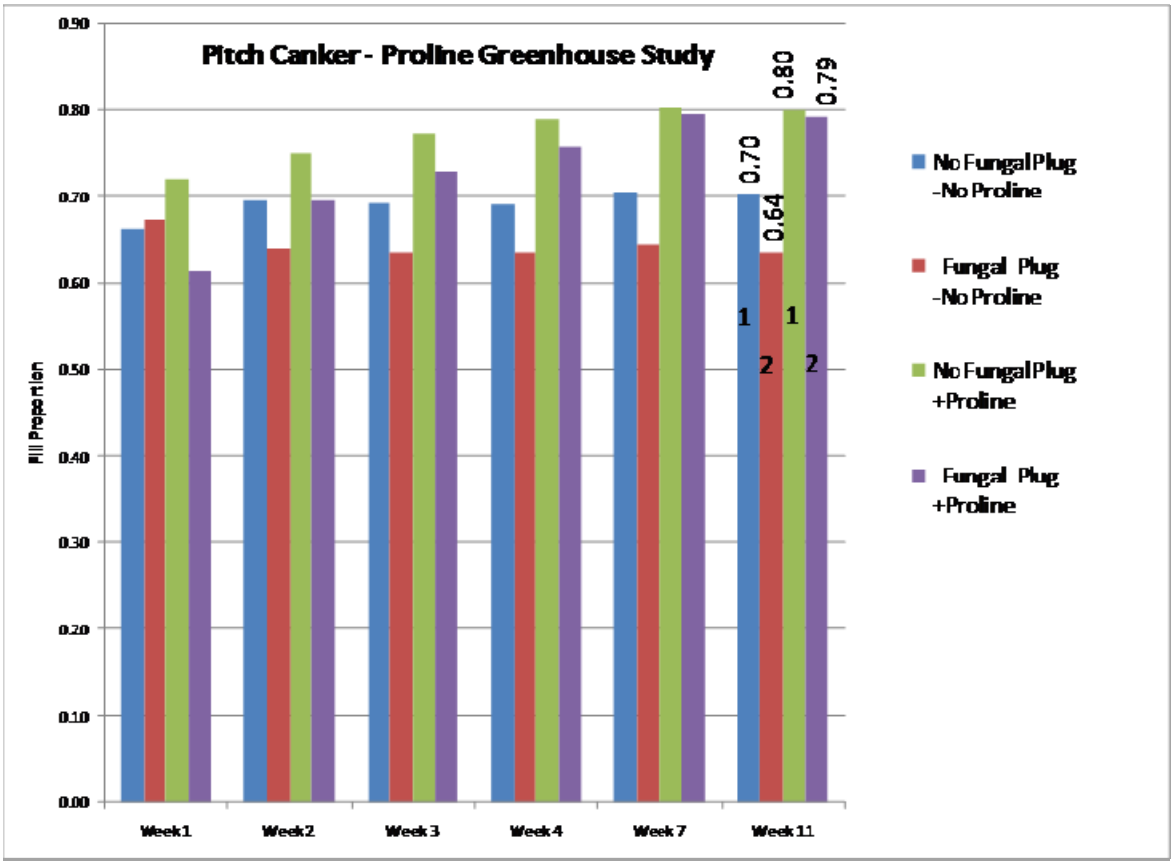

Figure 2. Fill percentage of treatments sprayed with Proline®.