Phytophthora Root Rot Update

By Jill Sidebottom and Mike Benson

I reported to the North Carolina Christmas Tree Association in April about the research Dr. Benson and I conducted on Phytophthora root rot control through grants from the association. The following is an update based on work conducted in 2003, some of which is even more recent than the NCCTA meeting in Sparta. The grant, funded for $5,000 between November 2000 and February 2002, had two components – a lath house screening of new fungicides for Phytophthora root rot control and a field study looking at materials that were currently labeled and known to have activity against Phytophthora.

In the lath house study, trees were planted in two-gallon containers, then artificially inoculated with the pathogen by placing infested rice grains into the soil. The moisture levels were kept high through irrigation to encourage disease development. In the field, fungicides were screened on portions of fields where Phytophthora root rot was already developing.

A summary of this research was handed out in Sparta to summarize the work completed through the granting period of 2002. However, since we still had fungicide left, and the NC Forest Service gave us free transplants for the lath house study, we were able to continue the work a third year both in the field and in the lath house. We only continued working in two of four the field sites that showed the most promise. These were in Avery County where the most disease had developed previously in the untreated controls, and in Watauga County where the trees were still several years from harvest.

The third year, 2003, was a lot different from the previous two years. It rained. It rained a lot. We finally had disease developing in the Watauga County field trial site (Figures 1 & 2). There was also considerable rain in Raleigh where the lath house study was located. In fact, the containers were kept wetter than they had the previous two years, allowing much more disease to develop.

The results of all this rain were that products that had been controlling Phytophthora root rot reasonably well in the past weren't nearly as effective.

Subdue was one of these products which has always been the standard for Phytophthora root rot control. In the lath house study, the trees treated with Subdue died just as if nothing had been applied (Table 1). At the Watauga County site, the field trees died in several of the Subdue plots (Figures 1 & 2). However, when you look at Figure 2, you can see that the most disease was found in the lower right-hand corner. There is a swag in this corner where water from other areas of the field collects. The Subdue Maxx and Subdue granular plots in replication 1 and Subdue Maxx in replication 2 were all in this low lying area and disease exploded in this plots this summer. However, the Subdue treated plots are continuing to perform well in the Avery County field (Figure 2).

Aliette also didn't perform in the lath house study as well as in the past. The Aliette soil drenches did work slightly better than the Aliette foliar sprays. However, this method of application would probably only work well in plant beds and not in the field. Jeff Vance, the county extension director in Mitchell County, and I are looking further at Aliette – either applying it once or three times through the growing season as a foliar spray. Biophos and Vital are products similar to Aliette that have in the past performed as well as Aliette in previous lath house studies.

The most interesting material is Stature-DM (dimethomorph), a BASF fungicide marketed by SePro. There was virtually no disease that developed in the lath house when trees were treated with this product. Again, as a soil drench, it probably wouldn't be too effective in the field and if it needs to be applied every 30 days, the cost would make it prohibitive. However, it might be something to look at in plant beds.

So what's the take-home message for growers? Using fungicides in the field to control Phytophthora root rot isn't going to cure the problem. Disease losses won't be eliminated, only reduced. The only thing it might buy you is time to get the trees out of the field and sold. When weather conditions make disease pressure greater, control will also be reduced. These products must be applied several times through the growing season, making any of them an expensive proposition. It takes about $100 of Aliette to fill a 100-gallon tank, and we were applying it three times a year. If applications are stopped, disease development will continue – there will be no residual effect.

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There may be times when using a fungicide would save enough trees to make their use worthwhile. This was certainly true in the Avery County site where disease has continued to develop in the untreated checks while disease development has been greatly slowed in the fungicide treated plots. However, at the Watauga County site, disease didn't develop for two years and when it did because of all the rain, it totally overwhelmed any control from fungicides in the worst areas. Since it's impossible to second-guess the weather it makes the decision to treat or not to treat in the field a gamble and a stopgap measure at best.

In plant beds it's a different story. These materials become very important in not allowing Phytophthora to become established and should be used throughout seedling and transplant production. Rotating between Subdue and Aliette is a good strategy. As we learn more about some of these other materials such as Stature-DM, these may also fit into a fungicide rotation for seedling production.

We hope to continue to make field applications of Aliette and Subdue at the Avery and Watauga County sites in 2004. Special thanks to Jerry Moody, Jeff Vance, and Jim Hamilton for their assistance with these trials.

Table 1. Effect of fungicides on Phytophthora root rot development on Fraser fir seedlings in the lath house from June to September, 2003 as measured by weight of tops and a root rot rating of 1=no disease to 5=dead plant.

Treatment	Rate /100 gal	Apply to	Top weight (g)	Root rot rating (1-5)*
901 Untreated check	--		34.5 cd**	5.0 a
902 Biophos	1.0 %	Foliage – 4 times	37.3 cd	4.6 ab
903 Biophos	2.0 %	Foliage – 4 times	39.3 cd	4.8 a
904 Vital 4L	2 pts	Foliage – 4 times	45.3 cd	4.0 abc
905 Vital 4L	4 pts	Foliage – 4 times	41.6 cd	4.6 ab
906 Aliette 80W	5.0 lb	Foliage – 4 times	32.2 d	5.0 a
907 Subdue 1G	250lb/acre	Soil surface – 2 times	49.3 cd	3.3 bcd
908 Aliette 80W	12.8 oz	Soil drench – 2 times	50.9 abd	4.0 abc
909 Stature-DM 50W	6.4 oz	Soil drench – 4 times	64.4 ab	2.1 d
910 Subdue Maxx 2E	0.5 oz	Soil drench – 2 times	35.4 cd	4.6 ab
911 ZeroTol 27%	1:50	Soil drench – 4 times	34.5 cd	5.0 a
912 Uninfested check	--		64.4 ab	2.9 cd
913 Uninfested check	--		67.1 a	2.1 d

*Root rot rating scale was 1= healthy, full root ball, 2= some root rot less than full root ball, 3= severe root rot, 50% of root system necrotic, 4= very severe root rot, root ball falls apart, and 5 = plant dead, all roots necrotic

** Means within a column followed by the same letter are not different according to the Waller-Duncan k ratio, k=100, p=0.05.

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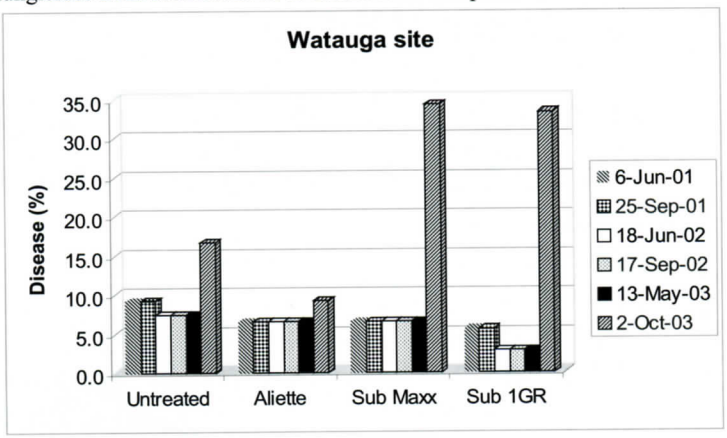
Figure 1. Phytophthora root rot disease development in two fields with the use of fungicides from summer 2001 to fall 2003 as compared to an untreated check.



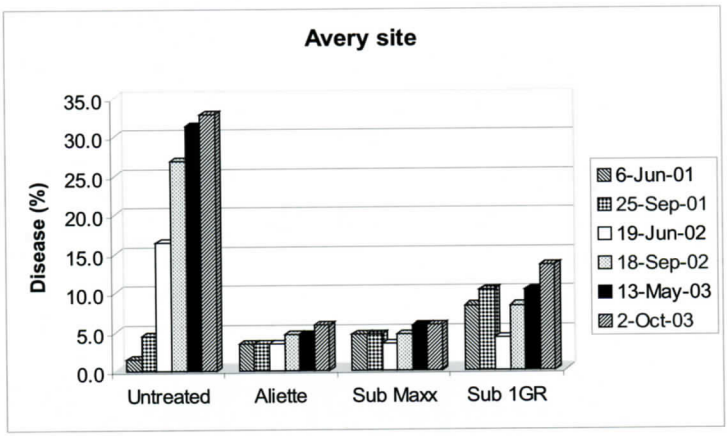
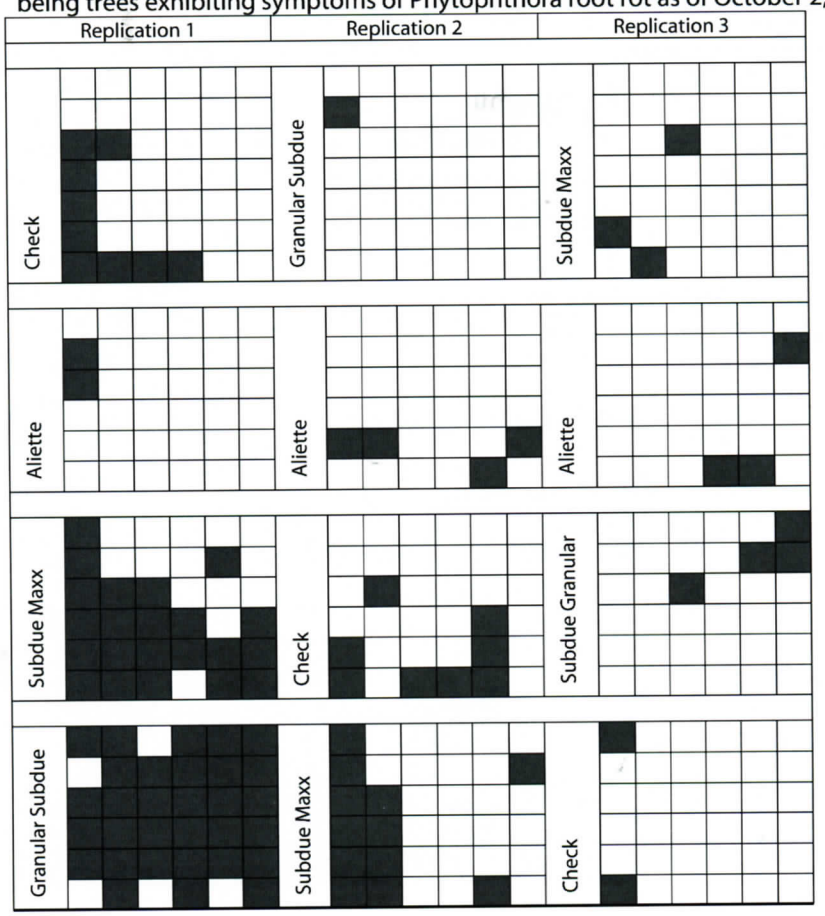


Figure 2. Field plot for the Watauga County site where trees were treated since summer 2001 with the various fungicides. Each box represents a tree with the colored blocks being trees exhibiting symptoms of Phytophthora root rot as of October 2, 2003.



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and her master's degree at NC State working in the tree improvement program. Her love of trees goes beyond work. Her husband, Dr. Richard Braham, is professor of forestry specializing in dendrology at NCSU. They are busy transforming their property, a former cow pasture, into a place two forestry professionals can be proud of.

Jianfeng also has a Clemson University connection. He received his master's degree from Clemson, working in the Plant Pathology department. Jianfeng came to the US from China in 1997. Before he came to the US, he worked with quarantines in a governmental program similar to APHIS.

Now he brings his considerable experience in plant pathology to doing most of the Phytophthora root rot research that John is involved with. He grows the fungal inoculum that is used to infect the different fir species to evaluate Phytophthora resistance in the greenhouse as well as work with the Phytophthora root rot field trials that John has in the mountains. He's been working in the project for three years.

He works at the molecular level as hard as he works in the field. Jianfeng took many isolates of *Phytophthora cinnamomi* that were collected in grower's fields and extracted the DNA to determine how much genetic variation there was in the population. He was able to identify two distinct types of *P. cinnamomi* found locally that Dr. Frampton and Dr. Benson will be working with later.

Jianfeng in field

Jianfeng hasn't had the opportunity to visit China since he moved here, but he is hoping to go home next summer. The trip back won't be easy because Jiangfeng and his wife are from different areas of China and had worked in yet a third. He hasn't lost touch with home, though. "I call my parents once a week," he told me. Jianfeng and his wife have a fourteen-year-old son who keeps them on their toes. I got the impression that Jianfeng understands trees and fungi better than fourteen-year-olds. Who doesn't?

When I asked John if he had anything else to add about Anne Margaret and Jianfeng, his response was quick. "What can I tell you? They're great!" It's people like them, who aren't afraid of long days and hard work in the field, and yet bring the technical expertise to do work on computers and in the laboratory that help keep a program like the Christmas tree genetics program going. I certainly enjoyed the opportunity to work with them for part of the day and get to know them a little better. At the next field meeting, take a little time and thank them for all their dedication and hard work.