Biological Remediation of Damping Off on Conifer Seedlings at Meadow Lake Nursery Company

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Seedlots of different conifer species can often be impacted by diseases known collectively as damping off. Anecdotal evidence suggested that the biological fungicide RootShield was performing well in other nursery operations and also that coco coir was, as a seeding mulch, doing wonderful things for flower growers. A replication of standard fungicide treatments and a control were added. It was also decided to trial a seed soak in hydrogen dioxide, the modern equivalent of hydrogen peroxide, used for many years as a seed-born disease sterilant.

The results indicate that certain combinations of the treatments may have commercial application, but that more trials are needed. These particular seedlots apparently exhibited low seed vigor and no matter what treatments were applied, it was a difficult project to redeem.

More work is needed on seed-soaking techniques with hydrogen dioxide. Perhaps soaking seeds in water prior to the dip would have been a better procedure.

INTRODUCTION

Oregon? McMinnville? Where is that? "Why are we here in Minnesota?," you may ask. Nineteen years ago, Todd left Minneapolis to work for Bailey Nursery in Oregon. Within a few years he started backyard experiments in new production methods and liner taxa. He met Cheroyl and together the Ericksons started Meadow Lake Nursery in 1985. The nursery now consists of 500 acres and an annual liner production of 9 million liners.

I am honored to present this paper to the Eastern Region of I.P.P.S. I have added a list of references detailing the choice of seeding method, container, and materials for disease remediation.

Conifers! Meadow Lake grows rootstocks for both the ornamental and fruit-tree industries. We wanted to provide conifers for the ornamental industry geared to provide caliper or height-sized containerized seedlings for winter grafting and growing. The goal is to produce healthy vigorous plants in time for early fall potting or lining out.

I, Mic Armstrong, have been growing conifers for some time. Eastern Region members may remember a presentation I gave in St. Louis, Missouri, in December of 1992 which boasted a title even longer that this one. The aim then was also to reduce losses to the various pathogens that comprise damping off.

Growers like to experiment with new materials or new cost-effective methods to grow healthier plants with less hassle. We design the trial, gather materials, supervise the production, take slide pictures, write notes on the weather and try to eliminate unforeseen variables, and note the dates of various treatments. In addition, we keep the biological parts of the trial separate from chemical treatments and haul nonchlorinated water for biologicals that don't care for chlorine or bromide in the water. We take care that subsequent cultural practices are properly administered, take more pictures, and then when we get a few minutes we try to analyze the results.

METHOD

Two days prior to our scheduled seeding date in early February of 1999, a *Picea abies* seedlot was divided into two parts, one half was soaked in tap water and the other was given a 5 min. soak in 2% Zerotol.

Zerotol is formed by the fusion of hydrogen dioxide (hydrogen peroxide) with peroxyacetic acid. The manufacturer claims it is 10× more active than hydrogen peroxide and contains additives which allow it to remain stable and non-phytotoxic. Many nurseries are using it as softwood cuttings dip to replace fungicidal dips that have a long re-entry interval on the chemical label. Zerotol has a zero re-entry in the United States. It safely breaks down to oxygen and water, however, I would caution that the concentrated product is extremely caustic, therefore, eye and skin protection is essential for all handlers.

The seeds treated in the Zerotol treatment were then flushed in water (a cloth bag works well for the soak), then air-dried on a screen alongside the water-soaked seed on a separate screen. Once surface-dried they were placed into Ziploc bags and refrigerated at 34°F until seeding a couple of days later. In my experience species such as *P. abies* benefit from a water soak (as described) but not from a longer period of cold stratification.

Once the seeding process began on the arrival of our friend from Jiffy Products, things moved fast. We seeded over 100,000 cells that day and our Norway spruce experiment was part of it. We ran the water-soaked *P. abies* lot first, including our trays tagged for trial. Next, the Zerotol-soaked lot went through the machine and the marked trays were also seeded and placed on the same bench as the rest. Later that afternoon I applied the different products on trial.

The trial consisted of 40 trays of 300 pellets, four replications of five on both the Zerotol and water-soaked seed lots. To each of five replications RootShield (*Trichoderma harzianum* Fifai strain KLR-AG2) was applied in labeled quantities and the cells thus marked were drenched and separated from other treatments. Well water was used to dissolve this biological product in order that chlorine would not compromise the initial application. Note: many biologicals are adversely affected by chlorinated water, however manufacturers' protocol rarely mentions this. The second treatment involved pulverizing some coconut coir from a sample brick of dried product. The dust thus produced was broadcast over the top of the 10 trays tagged pink, avoiding other trays destined for noncoir treatments. The idea here was that anecdotal evidence has indicated that coco coir has "anti-damping off" effects and so we considered this worthy of further investigation. To avoid the possibility that the well water used to dissolve the RootShield had its own properties we drenched all other replications with an equal quantity of the same well water.

The final treatment was chemical. The rest of the pellets seeded would also be drenched with a fungicide, in this case Banrot, later that evening. In all future fungicide applications great care was taken to remove the RootShield, coir, and control replications from any danger of fungicidal spray. Frequently moving the treated trays, it was hoped, would effectively randomize the experimental blocks.

Unforeseen variables included the ease with which peat pellets can be either over- or underwatered within a given area if sprinklers are not perfectly tuned. A mouse, apparently heading for the newly seeded *Pinus thunbergii* and *Larix kaempferi* also could be considered as an unexpected environmental factor. We suspect that his effects were minimal to *P. abies* but devastating to the black pine and larch!

As the seeds germinated, general observations were made. Damping off was noticed in all the Norway spruce, both Zerotol-treated and otherwise. Other conifers seeded were also affected to one degree or another. Fungicides such as Chipco, Cleary's, Subdue, and Daconil were applied to all except the RootShield, coco, and control replications which were isolated from sprays.

RESULTS

In this particular trial it was decided that the numbers of plants surviving transplanting to 2¼-inch pots from each of the different treatments would constitute the data. Using a Bouldin & Lawson Transplanter, seedlings were planted onto dibbled trays of Landmark 32 cell 2¼-inch pots. Each tray was labeled for each replication with the appropriate tag printed in the same colored plastic as in the initial experiment.

Table 1. *Picea abies* seeded and transplant data.

Description	Seeded 2/11/99	Transplanted 5/20/99
Control	1500	736 (49)[X]
Coco coir	1500	1216 (81)
Zerotol coco coir	1500	288 (19)
Chemical	1500	820 (55)
Rootshield	1500	992 (66)
Zerotol rootshield	1500	384 (26)
Zerotol control	1500	800 (53)
Zerotol chemical	1500	832 (55)

[X] Number in () = % transplanted

DISCUSSION

It would appear that the two biological methods without the Zerotol-soak (coco and Rootshield) were the best. Visually, however, some damping off was present on all treatments. The application method/rate for treating tiny peat pellets may be critical. The negative interaction with Zerotol observed apparently in coco and RootShield seemed odd. Perhaps we should have imbibed the seed with water prior to the Zerotol dip. Another hypothesis could be coco coir mulch actually prevented seedling desiccation, and any old organic mulch would have helped? One factor that we should have considered is that of seed vigor. Old or poorly stored seed may still be viable, but once germinated it lacks the energy to make a healthy seedling. A high percentage of runty and weirdly branched seedlings is indicative of this phenomenon. The *P. abies* lot chosen for this trial apparently exhibits poor vigor.

Other species seeded on the same day had varying results but some were excellent, i.e., seedlots of good vigor. Over 80% of the single seeded Jiffy cells eventually made 2¼-pots with uniform growth.

Although coco coir on seeds untreated in Zerotol win the "contest", this nursery won't be relying on it as a damping off preventative quite yet. We will, nevertheless, attempt to repeat the experiment with a high vigor seed lot in the Year 2000, perhaps expanding the products to include some new biologicals I have recently acquired.

We will continue to experiment with the Jiffy method of seedling production. The growth and root systems produced by transplanting the juvenile "peat plugs" are phenomenal. In addition, the seeding adaptations allow for high volume production of multiplicity of normally difficult species.

My conclusions to the previous biological trial I alluded to in 1992 at Vans Pines indicated that good cultural practices were more important than any other component. I will continue to trial biological and new chemistry in the pursuit of the best quality seedling and targeted production. However, I doubt if any of them will help if good seed quality and cultural practices are not at the beginning of the recipe.

LITERATURE CITED

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