Auburn University
Southern Forest
Nursery Management
Cooperative

# RESEARCH REPORT 01 - 13

## SEED TREATMENT WITH BENLATE REDUCES *Fusarium* ASSOCIATED LONGLEAF SEEDLING MORTALITY IN CONTAINERS.

by
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**INTRODUCTION**

Information on mass-producing container seedlings became generally available to southern nurserymen in the early 1970's with trials for longleaf (*P. palustris* Mill.) within a few years (Barnett 1975). Container longleaf survived outplanting better than bareroot seedlings but did poorly in containers where a long recognized problem with damping-off (Wakeley 1954) was not only more expensive but apparently worse than in bareroot beds (Pawuk and Barnett 1974). In early production, mortality was often 50%, and with bad seedlots germination of only 35% might be followed by up to 55% post-emergent mortality (Pawuk1978). Several species of *Fusarium* were regularly associated with seed and seedlings of which the more virulent isolates were often *F. moniliforme* (Pawuk1978) later renamed *F subglutinans* and now, apparently, *F. circinatum* f. sp. pini (Nirenberg and O'Donnell 1998). Treating seed with fungicides reduce losses (Pawuk and Barnett 1974) and although losses are seldom as bad as in the 70's (Carey and Kelley 1994) this is little consolation to nurserymen with a severe damping-off episode.

The cost of damping-off probably slowed the adoption of container production despite indications for superior survival after outplanting. The amount of *F. subglutinans* on seed significantly affected the amount of damping-off in the nursery. This study addressed the needs of members of the Auburn Nursery Cooperative and evaluated both the relationship between seed infestation and fungicide treatment on subsequent mortality in container production.

## METHODOLOGY

Seed orchard clones were rated for symptoms of pitch canker and seed were collected from five clones representing high, intermediate and low rated clones. Seed were processed commercially, and sub-samples from each of five longleaf clones were assayed for *Fusarium subglutinans* infestation at the USDA Forest Service's Asheville, NC laboratory and at the Forest Pathology Laboratory at Auburn using the blotter paper technique developed by Anderson (1986). On April 16, 2000, four pre-sow treatments were applied to seeds of each longleaf clone. Treatments were nine minute soaks in distilled water (control), or a nine minute soak in 2.5 % ai Benomyl (50 gm/L Benlate® SP) or 2.5% ai thiophanate-methyl (35.7 gm/L Topsin M® ), or a three minute stirring in 10% ai Maneb (140 gm/L Manzate® 200 DF ). Maneb treatments were in 100 ml of "slurry" and other treatments were in 500ml suspensions with each clone by treatment processed in a fresh treatment aliquot. Five hundred seeds of each clone received each treatment and were then surface dried, subdivided into 6 sub-lots of ≥ 80 seeds each.

On April 17, treated seed were single-sown at the International Forest Company (IFCo.) container nursery near Odenville, AL in their containers machine-filled with their regular soil-less media. One 80 seed lot of each clone (n=5) by pre-sow treatment (n=4) was randomly assigned to each of six sowers. After sowing, all cells were covered with about 0.5 cm of screened pine bark. The sown containers were maintained by IFCo on their regular production schedule for water, fertility and pest control (McRae and Starkey 1996).

Numbers of live seedlings were recorded May 15, June 5, and July 15 (28, 49, and 89 days after sowing) and ten surviving seedlings were harvested from each treatment replicate on October 17, 2000, (183 days after sowing) to determine biomass and RCD. Numbers and sizes of seedlings were analyzed for differences attributable to clone, treatment, sower, and clone by treatment interaction using SAS ANOVA.

## RESULTS

Estimates for pitch canker symptoms in the 1999 orchard survey correlated with amounts of *F. subglutinans* on the seed collected $R^2 = 0.89$, $P = 0.04$). Clones 131 and 137 were most severely affected by pitch canker, clones 119 and 135 were the least severely affected and clone 118 was intermediate. Germination and cavity fill by clone for not treated seed are presented in Table 1. The affects of the seed treatments are presented in Table 2. Benomyl, as reported by Barnett et al (1999), improved both germination and survival, especially of seed lots with poor germination due to *Fusarium*. The other two seed treatments did not improve production. Unfortunately, the label for benomyl has been withdrawn, and the other two seed treatments were not effective as applied in this study.

**Table 1.** Germination mortality and growth among container-grown longleaf seedlings, from not treated seed, from five seed orchard clones differing in infestation by *Fusarium subglutinans*.

| Clone | Fill†(5/15) | Fill (7/15) | Mortality· | Roots§ | Shoots |
|---|---|---|---|---|---|
| 131 | 53.2 bc | 27.8 d | 47 a | 1.26 a | 4.18 a |
| 137 | 58.2 ab | 34.2 c | 41 a | 1.21 a | 3.24 ab |
| 118 | 48.2 c | 31.7 cd | 33 b | 0.88 b | 2.60 b |
| 119 | 57.8 ab | 39.4 b | 32 b | 1.29 a | 2.86 b |
| 135 | 65.5 a | 56.5 a | 13 c | 1.21 a | 2.55 b |
| *lsd* | 7.5 | 4.7 | 7.3 | 0.30 | 1 1 |

† Fill is the number of the 80 cells sown per replicate that contained a seedling on the dates indicated

· Mortality is the percentage of seedlings that died between 5/15 and 7/15 after emerging.

§ Mean oven dry weights of seedlings 183 days after sowing (Oct 17).

**Table 2** Germination and mortality among container-grown longleaf seedlings, by seed treatment for five seed orchard clones differing in infestation by *Fusarium subglutinans*.

| Treatment† | Fill· (5/15) | Fill (7/15) | Mortality§ |
|---|---|---|---|
| Benomyl | 62 a | 50 a | 18 a |
| Thiophanate methyl | 53 b | 37 bc | 31 c |
| Maneb | 54 b | 34 c | 37 bc |
| Control | 56 b | 38 b | 33 b |
| *lsd* | *5* | *3* | *4.5* |

† Treatments were a 9 minute soak in 2.5% ai Benomyl or 2.5%ai thiophanate methyl or a 3 minute stir in 10% ai Maneb.

· Fill is the number of the 80 cells sown per replicate that contained a seedling on the dates indicated.

§ Mortality is the percentage of seedlings that died after emergence.

## MANAGEMENT IMPLICATIONS

The study demonstrated that pitch canker among clones of mature longleaf in a seed orchard correlated both with incidence of *F. subglutinans* inoculum among their seed and with seedling mortality. This indicates that removing orchard clones based on the incidence of pitch canker should reduce the infestation of collected seed and the percentage of seedlings that become diseased in the nursery. Although the only fungicide that was effective in this trial was lost due to the manufacturer's cancellation of the label for business reasons, there is a potential for effective control if the other tested products are applied differently.

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