Auburn University Southern Forest Nursery Management Cooperative

RESEARCH REPORT 03-02

THE EFFECTS OF FAMILY, SEED TREATMENT, AND SOWING TECHNIQUE ON CONTAINER PRODUCTION OF LONGLEAF SEEDLINGS AT GOLDSBORO NORTH CAROLINA IN 2002

by
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INTRODUCTION

There have been problems with damping-off of container grown longleaf for about as long as that species has been produced in containers (Pawuk 1978). The pathogens most often associated with these problems are species of *Fusarium* and in particular the causal agent of pitch canker *F. circinatum* (= *F. subglutinans*) (Pawuk 1978, Carey and Kelley 1994) which can be seedborne and at least sometimes correlated with the disease in the seed orchard clones (Carey et al 2002). Fungicides and disinfestants economically improve cavity fill by reducing, but not preventing, disease losses (Barnett et al 1999).

Until its registration was withdrawn, Benlate was the most effective fungicide for improving germination of longleaf seed. Since then, several fungicides and disinfestants have been screened with variable success but none have been as safe or reliable. The research reported here is part of the continuing effort to identify a reliable method to improve production of longleaf pine.

METHODOLOGY

Pitch canker incidence and severity were estimated for clones in the Bladen Lakes seed orchard on Oct 9, 2001. Cones were collected from three clones based on availability (that years production), their historic record for pitch canker from several annual surveys, and previous screening work. The cones were transported to Auburn University and placed in open tubs in a greenhouse at until seed shed naturally. Those seed were placed in plastic bags and kept at 4° C until sown.

Two seed treatment products [Vitavax®PC (45% Captan, 15% PCNB, 10% Carboxin)and TOPS® 90 (38% Captan, 13% PCNB, 8.5% Carboxin and 13.5% thiophanate-methyl)] were provided by Gustafson. Treatments were applied to longleaf seed taken from storage on April 22. The Vitavax PC was applied at 10.7 oz/100 lbs (0.6%) and the Tops 90 was applied at 11.7 and at 23.5 oz/100 lbs. so that at the lower rate both products contained about the same amount of Captan. Approximately 600 longleaf seed with wings (2.1 oz or 60 gm) of each half-sib family received each of the three treatments and a fourth group was similarly treated with distilled water only. Enough water was added to a zip lock bag to cover the seed and any excess was immediately shaken out. The dry fungicide treatment was added to the surface moistened seed and the contents shaken and stirred to distribute the treatment evenly. After two hours, each seedlot by treatment replicate was divided into five subsets of approximately 100 seed each and placed back in storage (4° C) for 24 hours before being transported to Goldsboro, NC and sown on 4/24/02.

Containers were filled with a media consisting of two parts peat to one of pearlite and one of vermiculite. Five sowers each single-sowed two 45-cell racks with seed from each seedlot by treatment combination and their sowing technique was recorded. Three sowers placed their seed flat on the soil surface and two held seeds by the wing and pressed them about a quarter inch into the media. Sown containers were covered with vermiculite, watered, and randomly distributed within a section of the production area then covered with shade cloth to prevent bird damage until after germination. Seedlings were maintained with the rest of the longleaf crop by the North Carolina Division of Forestry. Germination was recorded at 15, 21, 28 and 90 days and survival and seedling growth at 209 days after sowing (Nov. 20). Five live seedlings were harvested from each rack (10 from each treatment replicate) to determine mean weight and RCD. Germination and seedling growth were analyzed for the effects of family, for fungicide seed treatment, and sowing technique (where technique is nested in sower) and for interactions between family and treatment using SAS GLM. Differences between means were assessed using SAS Duncan's.

RESULTS

Means by seed orchard clone, by fungicide seed treatment and by depth of sowing are presented in Table 1. There was no interaction between any analyzed variables. The three seed orchard clones collected in 2001 (137, 119 and 135), ranked in their expected order for pitch canker as assessed at the orchard. As in previous years, vegetative symptoms in the orchard were most severe for clone 137 (?0.05) and though the other two did not differ, their order was consistent with past surveys (Carey et al. 2000). As in earlier studies, seedling production (cavity fill) differed significantly for each of the three half-sib families (Carey et al. 2001).

Table 1. Production of container grown longleaf seedlings at Goldsboro NC by seed orchard clone, seed treatment, and sowing technique in 2002.

Variable	Level †	N	Day 15*	Day 90	Day 209	RCD§
Clone	135	20	61.9 a	62.7 a	59.2 a	7.0 a
Clone	119	20	44.8 b	48.4 b	44.1 b	7.0 a
Clone	137	20	41.7 b	41.3 c	37.3 c	6.1 b
	lsd		*3.7*	*4.0*	*4.4*	*0.4*
Fungicide	None	15	48.6	43.8 a	39.3 a	6.4
Fungicide	Vitavax @ 0.10	15	48.6	50.9 b	47.6 b	6.6
Fungicide	Tops 90 @ 0.12	15	48.9	53.1 b	48.6 b	6.9
Fungicide	Tops 90 @ 0.23	15	51.9	55.3 b	51.9 b	6.9
	lsd		*4.3*	*4.7*	*5.1*	*0.5*
Sow Depth	1/4 inch	24	42.7 a	47.0 a	43.5 a	6.2 a
Sow Depth	on surface	36	54.1 b	53.4 b	49.1 b	7.0 b
	lsd		*3.5*	*3.7*	*3.8*	*0.3*

† For fungicide, the number after the "@" is rate in oz/lb of seed. For Sow Depth, the 1/4" was sown by holding wing and pressing seed into media with wing left exposed.

* Seedlings per 90 sown seed on 15, 90 or 209 days after sowing.

§ RCD is mean root collar diameter for five live seedlings from each of two racks sown for each treatment replicate.

The three seed treatments improved production but did not differ from each other. Treatment effects by half sib family are presented in Table 2. There was no apparent phytotoxicity, which is an improvement compared to Benlate which sometimes reduces germination of the better seedlots. In fact, although seed treatment made the largest percentage increase for the worst seedlot (76% increase over control for lot 137) the most additional seedlings were produced in the best seedlot (27 additional seedlings per 90 seed for lot 135). It is apparent from Table 1 that all treatments would be cost effective. Treatments increased production by an average of 11.2 % compared to controls. Assuming 5,000 longleaf seed /lb were treated with 12 oz/100 lbs seed, then treating an equal mix of seed from the three half sib families and sowing with nursery conditions like those at Goldsboro in 2002 would be extremely cost effective.

Table 2. Container longleaf seedlings per 90 sown seed by seed treatment and seed orchard source at Goldsboro in 2002.

		Seedlings per 90 seed by Orchard Clone		
Treatment	Rate (oz/100 lbs seed)	Clone 137	Clone 119	Clone 135
None	NA	25.8 a	41.6	50.4 a
Vitavax	10	39.8 b	44.0	59.0 b
Tops 90 @ 0.12	12	38.4 b	47.4	60.2 b
Tops 90 @ 0.23	23	45.2 b	43.2	67.4 b
	lsd	*9.1*	*8.3*	*8.1*

MANAGEMENT IMPLICATIONS

Interpreting the effects of seed treatment and disease among clones is more straightforward than is sowing technique. Sowing depth to maximize germination is a function of surface moisture during germination such that shallow sowing is best if constant moisture can be assured (Barnett 1978, Chan et al 1968). The optimal sowing depth could vary from nursery to nursery depending on the media used and the ability to insure that drying does not occur during germination. These data show the importance of avoiding sub-optimal sowing techniques and a type of simple study that can determine techniques to avoid.

Some people fear the loss of genetic diversity associated with roguing seed orchards but there is sometimes a price to pay. In this case a price would be paid by nurserymen. Among clones with 4 or more ramets in the 2001 orchard, survey data were collected for 170 ramets in 21 clones. Fourteen ramets were for clone 137 and a total of 48 ramets were for clones that were about as bad. That is, about 25% of ramets belonged to clones similar to 137 in pitch canker incidence. The three clones evaluated in this study are believed to represent the range of pitch canker symptoms pretty well. Therefore, if seed were collected from all clones, mixed, and used to sow 1 million cells (so 1% = 10,000 seedlings), without effective treatment the expectation from Table 1 is for 435,000 seedlings. Not collecting from the clones like 137 (worst 25% of ramets) cuts loss by 7.6%. Adding the standard rate of Tops 90 improves production another 8.7% and using just the best sowing technique yields another 1.2%. If the cost of seed, materials and labor is $100/1,000 sown cells and sale price is $200/1,000 then the worst case (all clones, ineffective treatment and mixed sow techniques) produces a net loss of $13,000 and the best case (better clones, effective treatment and best sow technique) a profit of $22,000.

LITERATURE

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