

ETHYLENE ABSORBENT INCREASES STORABILITY  
OF LOBLOLLY PINE SEEDLINGS

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Abstract.--Adding the ethylene absorbent, Purafil<sup>®</sup>ES, to bags of loblolly pine seedlings held in cold storage for 6 weeks improved root regeneration of seedlings over that of the control. Field survival was also increased after storage of 3 and 6 weeks with Purafil ES sachets. Treatments did not affect seedling height after one growing season.

Additional keywords: *Pinus taeda*, seedling survival, Purafil<sup>®</sup>ES, potassium permanganate.

Ethylene can damage many plants and fruits in storage (Abeles 1973). In amounts as low as a few hundred ppb, ethylene can reduce plant vigor, intensify aging of various plant parts, and reduce stock quality. Dormant nursery fruit stock is damaged if stored in an atmosphere containing ethylene (DeClement et al. 1979). Ripening fruit produces ethylene; other plant tissues also do so (Lieberman and Juniski 1971, Mapsom and Hulme 1970). Mechanical injury increases ethylene production (Kramer and Kozlowski 1979), so the lifting of nursery seedlings probably results in ethylene being produced in their roots. The sensitivity of plants to ethylene varies, and we have little information on how sensitive pine seedlings in storage might be to ethylene.

This study examined how including an ethylene absorbent in storage bags of loblolly pine seedlings affects root regeneration and field survival and growth.

METHODS

On January 4, 1979, I lifted loblolly pine seedlings, grown at the Columbia Nursery of the Louisiana Office of Forestry, and separated them to provide for three replications of treatment variables. Treatments consisted of 21 and 42 days of storage with and without ethylene absorbent. The absorbent is potassium permanganate absorbed on an aluminum (Purafil<sup>®</sup>ES<sup>2/</sup>) medium; it oxidizes ethylene to water and carbon dioxide (Abeles and Heggstad 1973). Purafil ES is packaged for several applications. In this study two small sachets (24 g each) were placed in polyethylene bags that contained about 50 seedlings. The sachets were stapled inside the bag so they would not contact water, which could reduce the effectiveness of ethylene absorption.

After 21 and 42 days of seedling storage at 34°-36°F, five seedlings per treatment replication were potted in sand and placed in a growth chamber for evaluation of root regeneration potential. The growth chamber was programmed for constant 75°F temperatures and 18 hour photoperiods of 1500 footcandles. After 4 weeks in the growth chamber, seedling roots were washed from the sand and numbers of new roots counted. The number of new roots per seedling was used as an estimate of root regeneration potential.

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<sup>2/</sup> Mention of trade names is for information only and does not constitute endorsement by the USDA Forest Service.

Another 25 seedlings from each treatment replication were outplanted on a silt loam soil. Survival and heights were measured in the dormant season 1 year later.

The data were statistically analyzed in a completely randomized design. The 0.05 level was used to show significance in root regeneration potential. The 0.10 level was used for statistical tests of field measurements because I expected greater variation in the field data.

### RESULTS AND DISCUSSION

Adding Purafil ES sachets to bags containing loblolly pine seedlings did not affect root regeneration potential after 3 weeks of storage. But after 6 weeks, seedlings with the ethylene absorbent produced significantly more new roots (Table 1). Bags with two sachets enclosed averaged 149 new roots after 1 month; bags without sachets averaged only 85 new roots

Table 1.--Root regeneration potential (RRP), survival, and heights of loblolly pine seedlings lifted from nursery beds and stored in polyethylene bags with and without ethylene absorbents a/

Treatment	Rep.	Stored 3 weeks			Stored 6 weeks		
		RRP No.	Survival Percent	Height Feet	RRP No.	Survival Percent	Height Feet
Control	1	163	96	1.4	80	88	1.4
	2	133	76	1.2	90	88	1.3
	3	120	84	1.2	84	88	1.2
	Average	139a	85b	1.3a	85b	88b	1.3a
Purafil	1	125	96	1.2	158	92	1.4
	2	106	92	1.3	143	92	1.2
	3	159	88	1.3	147	96	1.2
	Average	130a	92a	1.3a	149a	93a	1.3a

a/ Means within columns followed by the same letter are not significantly different at the 0.05 level for RRP and at the 0.10 level for field measurements.

Seedling survival after one growing season was unaffected by length of storage, but Purafil ES in storage bags did improve survival by an average of 6 percentage points (Table 1). Seedling heights were not affected by either length or type of seedling storage.

Though no direct measurements of ethylene were made in this study, the improvement in seedling root regeneration and survival with the addition of an ethylene absorbent suggests that ethylene is produced in lifted pine seedlings. This ethylene production may be at least partly responsible for rapid deterioration of seedlings in storage.

## RECOMMENDATIONS

The results from this preliminary study are positive enough to justify further study. Additional studies should better identify concentration-response relationships and the cost effectiveness of adding ethylene absorbents to sealed storage bags or to cold storage facilities if seedlings are stored in bales. These evaluations should be made in terms of improved survival and growth in the field.

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