# STRATIFICATION OF LONGLEAF PINE

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Abstract--Stratification for 14 days improved the speed and total germination in almost all of 54 longleaf pine seed lots tested. The grower of longleaf pine seedlings can expect to realize improved seed performance and reduced seed costs by stratifying seed for 14 days. Care is urged in the handling of stratified seed to avoid premature germination, mechanical injury, or overheating of the seed.

Additional Keywords: Pinus palustris, germination, stratification.

## INTRODUCTION

The stratification of tree seed has long been practiced to break dormancy and speed germination both in the laboratory and in the field. Stratification of loblloly pine (Pinus taeda L.) for 30 days gives good germination and longer periods of prechilling give marked increases in speed and uniformity of germination (Man, 1956, McLemore and Czabator, 1961). On the other hand, Longleaf pine (Pinus palustris Mill.) *is* one species that has traditionally been considered nondormant, and no stratification has been recommended. The rapid germination *of* the seed, and the early germination of seed in cones stored under moist conditions would lead a person to keep longleaf pine seed dry until after it has been planted.

**In** 1987 there were several longleaf pine seed lots received at the National Tree Seed Laboratory that did not germinate as well as expected from the x-ray test and the care given them in conditioning at the seed plant. Although stratification traditionally would have been an unlikely choice of treatment, it was also one of the easiest treatments to use and one which the laboratory was equipped to routinely apply. A very favorable response to stratification was observed in several seed lots in question. Because of this response it was decided to conduct a paired germination test on all longleaf pine seed lots that would be submitted in the 1988 testing season. A paired germination test is a test that is conducted with and without stratification, or alternatively, with 2 levels of stratification.

## MATERIALS AND METHODS

A total of 54 seed lots were available for the paired testing. The first test was germinated without stratification and the second test was germinated after 14 days of stratification. A test consisted of 4 samples of 100 seeds. The germination media was crepe cellulose paper manufactured for seed testing. Stratification was on the germination media at 3 C. Germination temperature was 20 C and 8 hours of light were given during a 24 hour period. Counts of

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germination were made at 7, 14, 21, and 28 days after placing the tests in the germination room. Germination was defined as the emergence and development from the embryo of all essential plant parts necessary to produce a normal plant under favorable conditions (AOSA, 1981).

## RESULTS AND DISCUSSION

### Laboratory Germination

Overall stratification had a very beneficial effect. On the average the germination at 7 days increased 18%, at 14 days it increased 15%, and the final germination increased 10%. Individual seed lots gave a range of responses to stratification (table 1.), but very few showed no positive response and those that did have lower germination following stratification were reduced by only 5% or less. A difference of 5% or less in seed testing is considered to be not a statistically significant difference (AOSA, 1981). Increases in germination of greater than 10% at 7 and 14 days were observed in over half of the lots. The same level of increase was obtained in just under half of the seed lots at 28 days. Very substantial increases of greater than 20% were measured in 48% of the lots at 7 days, in 32% of the lots at 14 days, and in 19% of the lots at 28 days.

Table 1. The Effect of Stratification on Laboratory Germination of Longleaf Pine Seed.

| | Percent of All Tests With | | | | |
|---|---|---|---|---|---|
| Germination | Increases | Decreases | No Change | Increase > 10% | Increase > 20% |
| 7 Day | 74 | 8 | 18 | 63 | 48 |
| 14 Day | 96 | 2 | 2 | 55 | 32 |
| 28 Day | 96 | 2 | 2 | 46 | 19 |

Cool moist conditions in some circumstances will lead to the weakening or death of seed that is not vigorous. In general, low viability and low vigor go together. In the laboratory it is usually observed that a low viability seed lot will have a reduced germination following stratification. Although no significant reductions were seen, it would be good to ask if the response to stratification varied with the viability of the lot. Table 2 gives a summary of the seed lots by viability groupings.

It appears from these data that the total germination of lower-germination seed lots could be increased more by the stratification than could the germination of higher-germinating seed lots. This can be seen by comparing the 50 and 77 percentages against the 33, 46, and 10 percentages in the column for 28 day germination. In terms of speed of germination, more higher-germinating seed lots showed a substantial increase at 7 days than did the lower-germinating lots. A different response is observed when comparing high-germinating and low-germinating seedlots, but the effects were, on the average, for better performance. No detrimental effect was observed from the 14 day stratification.

Table 2. The Effect of Stratification on Laboratory Germination of Longleaf Pine Seed Lots Grouped by Germination Percentages.

| Germination Grouping | Number of Seed lots | Percentages of all seed lots with Increases of >10% 7 Day | 14 Day | 28 Day |
|---|---|---|---|---|
| 20 - 29 | 1 | 100 | 100 | 100 |
| 30 - 39 | 6 | 50 | 83 | 50 |
| 40 - 49 | 13 | 54 | 77 | 77 |
| 50 - 59 | 2 | 0 | 50 | 0 |
| 60 - 69 | 9 | 78 | 44 | 33 |
| 70 - 79 | 13 | 85 | 69 | 46 |
| 80 - 89 | 10 | 50 | 20 | 10 |

How does the stratification work to increase the germination of nondormant longleaf pine? The most likely explanation is that the seeds are given extra time to go through the initial physiological steps of germination and become ready to germinate promptly when conditions are favorable. This explains why the faster germination. The increased time would also give weak seeds more time to muster their limited resources, and this would explain the increase in total germination.

Stratification of Seed for the Nursery

With an average increase in total germination of 10%, faster germination, and no significant decreases in germination from stratification, it would seem that nursery managers should stratify longleaf pine seed. Substantial reductions in seed costs could be realized from stratifying seed. Assuming a purity of 98, 5000 seed per pound, the average germination in this study of 62, and a combined survival/nursery factor of 80, it would require 411 pounds of seed to raise one million trees. At the average stratified germination of 72, 354 pounds of seed would be needed to produce one million trees. This is a savings of 57 pounds of seed per million trees with a dollar value of about $1100 when paying $20 per pound. This savings would be of course reduced by the cost of material and labor to stratify the seed. Additional savings would be anticipated from improved survival rates and lower cull factors.

However, the application in the nursery should be approached with care. In the laboratory the seed were stratified after planting on the media and were transferred from cooler to germination in just a few minutes. In the nursery this transfer could take the better part of a full day or longer, and the seed subsequently subjected to high temperatures because of delays in planting. Also it is not known how long seed can be safely held in stratification without detrimental effects. Timing will probably be more critical in stratifying longleaf seed than it is for other pine species.

The common way to prepare seed for stratification at the nursery is to soak the seed overnight in water. In the author's experience and from personal communications with other seed workers it is known that some seed in most longleaf pine seed lots will begin germinating when the seed is soaked in water over night at room temperature. The soaking of seed could result in many sprouted radicles and the subsequent loss of these sprouted seed because of mechanical damage to the radicle. The soaking of the seed should, therefore, be done with chilled water in the cooler.

Because of the sensitive nature of longleaf pine seed to injury by mishandling, the grower of longleaf pine seedlings is cautioned to be sure of procedures used before adopting the stratification of longleaf seed on an operational basis. With a proper application of the procedure the grower could realize some very significant benefits.

## LITERATURE CITED

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