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Light Requirements for Germination of Loblolly Pine Seeds

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Abstract. The light requirement for germination of loblolly pine seeds can be met during stratification or germination. One hour of irradiation with light at a wavelength of 660 nm and an intensity of 600 ergs/cm²/sec fulfilled the light requirements for germination of seeds stratified for 28 days. Fifteen minutes of the same light at an intensity of 2000 ergs/cm²/sec was adequate when the stratification period was only 15 days. Exposure of seeds to light during stratification neither hastened nor increased germination in light. ***Forest Sci. 17:285–286.***

Additional key words. *Pinus taeda*, seed germination.

ACCORDING TO Nelson (1940), loblolly pine (*Pinus taeda* L.) seeds require light for germination, and Toole *et al.* (1962) showed that the positive response peaks at a wavelength of 660 nm, while wavelengths near 730 nm inhibit germination. This paper describes three studies into the quantities of light during stratification necessary to promote loblolly seed germination in light and darkness.

Previous research has shown that stratification for over 100 days eliminates the need of loblolly seeds for light (McLemore 1966). It was also demonstrated that a combination of light and stratification hastened dark germination of the seeds more than stratification in darkness (McLemore 1964).

Study 1. Three seed lots, each representing many trees, were cleaned to 100 percent soundness. Seeds were stratified for 28 and 56 days on a mixture of moist sand and peat moss in plastic germination dishes, which were placed in lightproof bags and held at a constant 4°C.

For both lengths of stratification, seeds were assigned to each of five durations and frequencies of irradiation during stratification: (1) irradiated for 1 hour twice a week, (2) irradiated for 1 hour once a week, (3) irradiated for 1 hour once every 2 weeks, (4) irradiated for 1 hour at end of stratification, and (5) unirradiated.

Three light intensities were provided for each frequency by employing 2, 8, and 16 fluorescent bulbs that were 6 ft long and provided cool white light. The light was filtered through two layers of 300 MSC red cellophane with a peak transmission at 660 nm. Irradiation intensities, as measured with a YSI model 65 radiometer, were approximately 600, 1,200, and 2,000 ergs/cm²/sec for 2, 8, and 16 bulbs. Relative brightnesses for the three intensities were approximately 5, 20, and 40 ftc.

Germination of 200 seeds from each treatment was tested in darkness at 22.5°C. Counts were made under a safe-green light after 7, 10, 12, 14, 17, 21, and 28 days. Germination percentages and germination values, which take into account both speed and completeness of germination (McLemore and Czabator 1961), were computed.

When seeds were stratified for 28 days and exposed to the different light intensities at varying intervals, germination ranged from 80 to 88 percent. Differences were not statistically significant at the 0.05 level. Hence, irradiation with 2 bulbs (600 ergs/cm²/sec) for 1 hr at the end of stratification fulfilled light requirements of these seeds just as well as irradiation twice a week with 16 bulbs. Only 45 percent of the seeds given no light germinated in 28 days.

Results of tests with seeds stratified for 56 days followed the same trend as for those stratified 28 days—there were no differences in germination percents or values among light treatments. Although germination of unirradiated seeds was greatly increased by stratification for 56 days, the speed of germination for these seeds was still significantly less than for those receiving light treatments.

Study 2. Since the threshold for light response was surpassed by all treatments in study 1, exposures were decreased in the second study. Four lots of loblolly pine seeds were stratified for 15 days. Seeds were then irradiated with 16 bulbs (2,000 ergs/cm²/sec) for 5, 15, or 60 min and their germination was tested in darkness. In addition, an unirradiated sample from each lot was tested in darkness and another sample was tested in light under standard lab-

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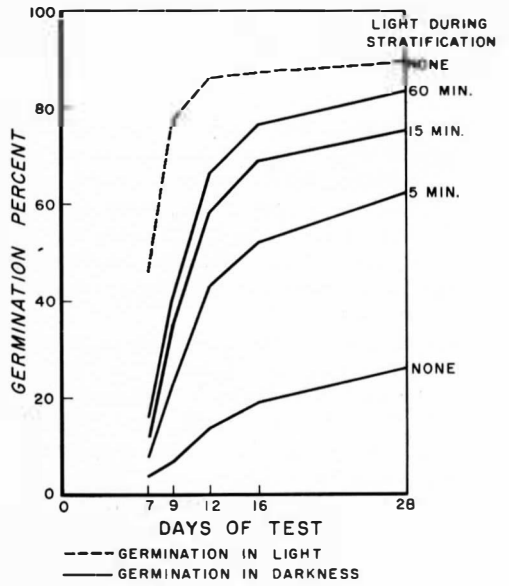

FIGURE 1. *Germination of loblolly pine seeds stratified for 15 days and subjected to different light treatments.*

oratory conditions (16-hr photoperiod at 120 ftc).

Increasing amounts of light resulted in progressively faster and more complete germination (Fig. 1). Germination of unirradiated seeds tested in darkness was only 26 percent in 28 days, while that of seeds tested in light averaged 89 percent. Final germination of seeds tested in light was not significantly higher than for seeds receiving 15 or 60 min of light and subsequently tested in darkness, but there was a significant difference in speed of germination, as reflected by germination values. Five minutes of light caused significant increases in both speed and completeness of germination over that obtained with unirradiated seeds. Since stratification is known to reduce the light requirements for loblolly germination (McLemore 1966), it is likely that the differences would have been smaller in this study if seeds had been stratified more than 15 days.

Study 3. This study was run to determine if light during stratification hastens germination in light. The same three lots of seeds used in study 1 constituted the replications. Four light treatments were applied during stratification: (1) irradiated 1 hour three times a week, (2) irradiated 1 hour once a week, (3) irradiated 1 hour every 2 weeks, and (4) unirradiated.

Seeds were stratified for 28 and 56 days. Irradiation for treatments 1 through 3 was obtained by filtering light from 16 six-ft fluorescent tubes through two layers of 300 MSC red cellophane, as in the first two studies. Following the stratification and irradiation treatments, 200 seeds from each treatment were tested in the seed laboratory under normal light conditions—a 16-hr photoperiod at light intensities of approximately 120 ftc—for 28 days.

Exposure to light during stratification neither increased nor hastened germination in light. Germination percents ranged from 80 to 89. Although an earlier study demonstrated that light administered during stratification has a pronounced beneficial effect on seeds tested in darkness (McLemore 1964), nothing is gained by supplying light during stratification if light is present during germination.

It is concluded that light hastens germination of loblolly pine seeds. The light requirement can be met during either stratification or germination. Seeds must be imbibed before they will respond to light, however (Toole *et al.* 1962). The amount of light necessary to trigger germination is low and, hence, is probably not critical in direct-seeding operations.

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