LIGHT REQUIREMENTS FOR GERMINATION OF IMBIBED LOBLOLLY PINE SEED

Frank W. Woods and Anthony P. Mollish [1]

Seeds of certain species germinate slowly if they do not receive light following imbibition. For example, Mosheov (1938) suggested that the external coat of wheat contains a growth inhibiting substance, which is subject to modification by light. Vaartaja (1952) and Redmond and Robinson (1954) found that birch seed requires light following imbibition, without which germination is very poor. The latter proposed that a water soluble agent in the seedcoat was responsible for the inhibitory action. Some species of Eucalyptus also require light (Boden, 1957; Free, 1951; Clifford, 1953; Grose and Zimmer, 1957). Other tree species that are benefited by light in a similar manner include Pseudotsuga menziesii (Allen, 1941), Pinus nigra (Heit, 1958), Paulownia tomentosa (Toole et al., 1958B), Pinus taeda(Tooleetal., 1958A), and Pinus virginiana (Toole et al., 1961). The phenomenon is probably more widespread than generally acknowledged.

During the course of investigations into the environmental requirements of Pinus taeda seed, determining the length of photoexposure required for the germination of imbibed seed became desirable. Two of six separate tests, which were made, are reported here.

Methods

A total of 12,000 loblolly pine seeds from the Piedmont and Coastal Plain of North Carolina, which had been held in dry cold storage for nearly 2 years, was used for the tests. Dry full seeds were counted into groups of 50 and each group wrapped in heavy, black, lightproof construction paper, which was folded several times to insure complete exclusion of light. The packets were tied with rubberbands, placed between layers of moist sphagnum moss in quart Mason jars, and stratified at a temperature of about 36^0 F. for 60 days. They were then removed from the jars in complete darkness, one packet at a time, and exposed to light sources for precise intervals. To obtain light durations of 1/1000 and 1/2000 seconds, an Ultrablitz Jet II strobe light with a color temperature of 5600^0 K. was used, while incandescent room lighting was used for light exposures of longer duration.

After exposure to the light sources, the seeds were placed in plastic germination dishes on clean quartz sand, which were, in turn, sealed in lightproof padded mailing envelopes and placed in a dark cabinet for germination. In this manner, the seeds were assured of receiving only one source of light for a controlled length of time following imbibition. At the end of 15 days, the dishes were removed from darkness and germination percentages recorded. Four replications of 50 seeds were used for each treatment and each seed source, as well as a check, which was germinated in a room with daily light. A second check received the same stratification treatment but received no light throughout stratification and germination.

Results and Discussion

Results of two representative tests of the five made are presented in table 1. Even 1/2000 second of exposure of the seeds to light gave an increase in germination percent

[1] Frank W. Woods, Asst. Professor of Silviculture. School of Forestry. Duke University. Durham. N. C.;Anthony P. Mollish, Happy Camp District, Klamath National Forest. V.S. Forest Service. Yreka, Calif.

over those that received absolutely none. Furthermore, seeds from both sources responded in a similar manner, indicating that the requirement for light is probably general for this species of pine.

To determine the effects of light intensity, 100 seeds from each of the two sources were exposed to the strobe light sources at varying distances. Germination, relative to the daily light check treatment, is depicted in the following tabulation:

Distance from light source	Relative germination
(cm.)	*(percent)*
2	31
4	27
8	19
16	18
32	12
64	7
128	6
256	4
Daily light	100
Total darkness	2

TABLE 1.--The effect of photoperiod on the germination of loblolly pine seed from North Carolina

Source of seed	Test 1		Test 2	
	Duration of exposure	Germination	Duration of exposure	Germination
	Second	*Percent*	*Second*	*Percent*
Piedmont	No light	17.5	No light	10.5
Coastal Plain	....do.....	10.0	....do.....	7.5
Piedmont	1/2000	58.0	1/1000	41.0
Coastal Plain	1/2000	53.5	1/1000	41.5
Piedmont	1/1000	64.5	5 minutes	55.0
Coastal Plain	1/1000	65.5	5 minutes	51.5
Piedmont	Daily	74.5	Daily	54.5
Coastal Plain	....do.....	80.5	....do.....	58.5

The decrease in germination with increasing distance illustrates the effect of light intensity on seed germination.

The lack of complete agreement in the results of different tests is possibly due to differences in temperature of the room in which germination tests were made, and over which there was no control.

These d at a emphasize the survival value of natural seed covering by litter and leaves in the forest. Through this mechanism, ungerminated seed might still be available after drought or fire had destroyed all seed sources and seedlings. For silviculturists, they indicate the importance of soil scarification in exposing to light seed from natural seedfall that have been stored and naturally stratified deep in litter and duff of the forest floor. In the past the benefits of scarification prior to seedfall have been attributed entirely to exposure of mineral soil and increased availability of soil moisture.

For tree nursery operators and land managers engaged in direct seeding operations, the implications are readily apparent. When uniform germination of seeds of at least

some species is desired, postimbibition (following either stratification or cold soaking) exposure to light is necessary. Especially if loblolly pine seed is to be imbibed and treated with a sticker and repellent, prior to sowing, it should be deliberately exposed to bright sunlight following stratification and before coating if a maximum rate of germination is desired. Even. though sufficient light may penetrate the repellent coating to induce germination (Woods and Beineke, 1962), such germination may not happen if treated seed is covered even slightly by mulch or soil.

Summary

The rate of seed germination of loblolly pine (Pinus taeda) was increased by photo-exposures as short as 1/2000 of a second, following imbibition in darkness and prior to germination tests made in darkness. Germination was also found to increase as intensity of photoexposure increased. A light-sensitive germination inhibitor in the seedcoat seems to be indicated.

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