

ARTIFICIAL LIGHT-A POSSIBLE PRETREATMENT METHOD FOR DORMANT WHITE SPRUCE SEED

HOWARD M. PHIPPS 1

Procedure

A quick pretreatment method for internally dormant seed would be a valuable aid to nurserymen in testing germination of seed from an unfamiliar source or in preparing additional seed when an original sowing has failed. The most widely used and successful method for treating such seed is that of cold-moist stratification. For white spruce this method usually requires at least 30 days. The related technique of cold-soaking, although taking less time, has not always given as rapid or complete germination as stratification (1).

In recent years, investigators have found that light will stimulate seed germination of some tree species. The seed of several of these species, such as Douglas-fir (2) and yellow birch (3), commonly show internal dormancy and are normally stratified to achieve good germination.

To explore the possibility of using light as a pretreatment for dormant white spruce seed, a series of tests was undertaken to compare germination of seed exposed to artificial light with that of stratified and cold-soaked seed. Also, light-treated seed was dried and stored in a refrigerator for two different periods to determine if time would reduce its reaction to light stimulus.

The seed for these tests was collected in 1962 from the Upper Peninsula of Michigan and until the time of the tests was stored in covered containers under dry cold-storage conditions (ca. 23° F). Germination percent, as determined by the Eastern Tree Seed Laboratory, was 89 percent at the time of collection. Some preliminary tests were run in 1965 but most of them were carried out during 1966 and 1967.

Samples were prepared by placing about 100 seeds on moist filter paper in petri dishes. The number of replications of each treatment ranged from 4 to 7. Treatments were as follows:

Stratification.-Seed was placed between layers of moist perlite and refrigerated for 31 days at 40° F.

Incandescent light for 2.5 hours.-Seeds that had imbibed distilled water for 2 hours were exposed for 2½ hours to light from six 75-watt tungsten filament bulbs. Lights were suspended about 14 inches above the seed. A 1/2-inch water bath between the lights and seed maintained the temperature in the dishes at about 75° F.

Fluorescent light for 20, 3, and 1 hours.-The light source consisted of five 40-watt cool-white fluorescent tubes suspended about 8 inches above

1 Associate Plant Physiologist, North Central Forest Exp. Sta., Forest Serv., U.S. Dept. of Agr.

seed. Otherwise, the procedure was the same as for treatment 2.

Light-treated and stored for 25 days.-Same as the 3-hour fluorescent light treatment, except seeds were air dried in the dark for 72 hours and stored for 25 days at 40° F.

Light-treated and stored for 4 days.-Same as treatment 6, except for storage period.

Cold-soak.-Seeds were soaked in distilled water in a refrigerator at 40° F. for 14 days.

Control.-Dishes were first made light proof by covering with aluminum foil and then handled as in above light treatments.

All dishes were incubated in the dark at about 70° F. Germination counts were made periodically on the same samples in subdued natural light conditions. Differences among all treatment means in each time period were tested for statistical significance according to the sequential testing method mentioned by Snedecor (4).

Results

Except for the first 7 days, there were not significant differences in germination among means for

stratification and light treatments (table 1). Storage after light treatment reduced germination but length of storage period had no apparent effect. Cold-soaked

TABLE 1.—Germination of white spruce seed by pretreatment

Treatment	Days after start of incubation	
	7	14
	Percent	Percent
Stratified	80.5 a	87.5 a
Incandescent light, 2½ hrs.	70.1 b	86.6* a
Fluorescent light, 20 hrs.	66.9 b,c	84.7 a
Fluorescent light, 3 hrs.	62.3 d,c	87.7 a
Fluorescent light, 1 hr.	52.3 e	84.7 a
Light treated & stored, 25 days ---	56.0 d,e	80.6 a,b
Light treated & stored, 4 days ----	50.4 e	79.8 a,b
Cold-soaked	62.0 b,d,c	75.0* b
Control	25.6 f	52.5 c

* Counted at 12 days.

Note: Within each column, percentage figures having common letters are not significantly different at the 5-percent level.

seed did not germinate as well as stratified seed or

light-treated seed that had not been stored. Germination of the control seed remained, as before, significantly less than all other treatments. A 3-week count revealed little additional germination. The control had increased 11 percent, the cold-soak treatment 3 percent, and the remaining treatments 1 to 2 percent. It is noteworthy that, at the second count, the germination of seed treated with incandescent light was within 1 percent of the germination of the stratified seed and within 3 percent of the value established by the Eastern Tree Seed Laboratory at the time the seed was collected (89 percent).

Conclusion

These tests indicate that artificial light may be a time-saving and effective pretreatment for some white spruce seed. The light-treatment effect is to a large extent retained after drying and storing in a refrigerator for as much as 25 days.

Literature Cited

- Chedzoy, J. C.
1967. Presowing, stratifying spruce and pine seed in plastic containers proves best in Alberta, Canada, test. USDA Forest Serv. Tree Planters' Notes 18(2): 1-3.
- Johnson, L. C. and Irgens-Moller, H.
1964. Effect of photoperiod and light quality on germination of Douglas-fir seed. Forest Sci. 10(2): 200-205.
- Redmond, D. R. and Robinson, Robena C.
1954. Viability and germination in yellow birch. Forest Chron. 30(1): 79-87.
- Snedecor, G. W.
1956. Statistical methods applied to experiments in agriculture and biology. Ed. 5, p. 251, 268. Ames: Iowa State College Press.