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OF JACK PINE AND RED PINE**

by  
J. W. Fraser

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# The Effect of Sunlight on the Germination and Early Growth of Jack Pine and Red Pine

by

J. W. Fraser<sup>1</sup>

Fraser and Farrar (1953, 1955) demonstrated that shading, watering, or seeding below the surface resulted in adequate germination of red pine (*Pinus resinosa* Ait.) and jack pine (*Pinus banksiana* Lamb.) seed. By manipulating these factors, either singly or in combination to prevent the development of drought and high temperatures in the seedbed, they obtained excellent germination. Their results also indicated that the best germination occurred under conditions not usually associated with the best growth of these species.

Since light is the only major factor that can be readily altered or controlled in forestry practice, study of the effect of sunlight on germination and early growth was initiated at the Petawawa Forest Experiment Station in 1952.

The treatments were designed in co-operation with H. Cameron<sup>2</sup> to give different degrees of exposure to the sun. The treatment shelters were made of 1-inch boards 3 feet long and 1 foot wide, placed on edge parallel to each other on a true north bearing. The height of the boards represented the height of the stand; the distance between them, in relation to the height, determined the number of hours of sunlight to which the surface was exposed each day. Distance between the walls was calculated from the height of the board and the elevation of the sun from sunrise to sunset on a given day. The actual hours of exposure are directly applicable only to that particular day, but the treatment ratios are constant. The treatments were as follows:

Hours of sunlight daily	Time of exposure	Distance between walls in inches
0	No exposure*	3.0
2	11 am—1 pm	3.0
4	10 am—2 pm	7.7
6	9 am—3 pm	14.5
12	6 am—6 pm	No walls

\* Masonite slats 12 inches high and 3 inches wide were placed vertically at 3-inch intervals to prevent any direct sunlight from reaching the surface.

The five treatments were replicated three times in a randomized block layout (Figure 1) on fine silty sand.

<sup>1</sup> Forestry Officer, Petawawa Forest Experiment Station, Chalk River, Ont.

<sup>2</sup> Meteorologist formerly seconded to the Forestry Branch from the Department of Transport.



FIGURE 1. Randomized block layout.

Four patches of 25 jack pine seeds were sown along the centre inch-wide strip at the north end of each treatment; the same number of red pine seeds was sown at the south end of each treatment.

New seedlings were tallied daily from June 22, when the first seedlings appeared, until the main experiment was terminated on July 17.

Two of the treatment blocks were left undisturbed until September, 1953, to demonstrate the effect of the treatments on growth at the end of the second growing season. All treatments were photographed in June and August, 1953, and the seedling heights were measured on the latter date.

The germination data were analysed by the variance method. Because of possible inaccuracies in making measurements in such confined spaces, no formal analysis was made of the height data. Figure 2 shows germination and height growth at the end of the second growing season.

Both species germinated best on seedbeds that were not exposed to sunlight. Germination decreased significantly (5 per cent level) only when the daily exposure period exceeded 4 hours. The poorest germination occurred when the seedbeds were exposed constantly.

Height growth of both species obviously improved with increased exposure, and jack pine grew taller than red pine at all exposure levels.

Although exposure was the only deliberately controlled feature in this experiment, caution should be exercised not to over-emphasize the effects of light as such in producing the responses shown in Figure 2. The exposure treatments should be accepted mainly as a convenient arbitrary index of the resultant environments.

The germination responses shown in Figure 2 were attributed mainly to variations in soil moisture and soil temperature associated with the periods of exposure, and the poorer germination that occurred when the seedbeds were exposed for 6 hours or more each day to the combination of soil moisture deficiency and high soil temperature that developed under such conditions.

The higher germination of red pine, except on fully exposed seedbeds, might be attributed to a higher germinative capacity due to inherent characteristics or related to conditions of storage of seeds. The low germination on the exposed treatments suggests that jack pine is less demanding than red pine in its moisture requirements.



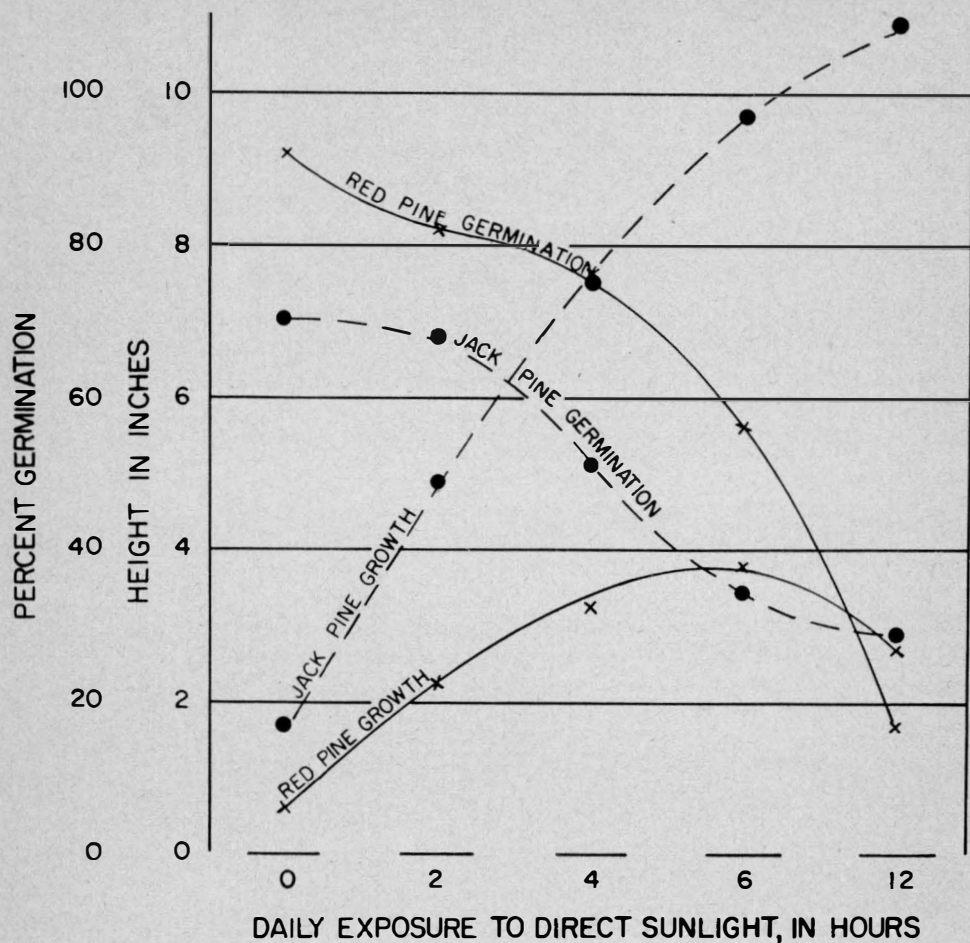


FIGURE 2. Germination and early growth of red and jack pine in relation to seedbed exposure.

The better jack pine growth under all conditions of exposure indicates a better inherent growth rate for this species at this age. The growth differential between species is illustrated in Figures 3 and 4.

The decrease in red pine growth with more than 6 hours exposure may perhaps be related to inferior root development in the drier, hotter, more open areas and a resultant inability to withstand the associated transpiration stresses. This suggests that soil moisture has a greater influence on the growth of red pine seedlings in relation to high exposure than it has on the growth of jack pine.

It is obvious from the results of this experiment that the conditions required for optimum germination of these two species are vastly different from those required for their optimum early growth.

Except in unusually favourable seasons, it is unlikely that optimum germination will occur naturally where conditions are such as to favour the best growth. The reverse is equally true. By avoiding extreme exposures that favour one process at the expense of the other (Figure 2), good germination and satisfactory early growth can be obtained.

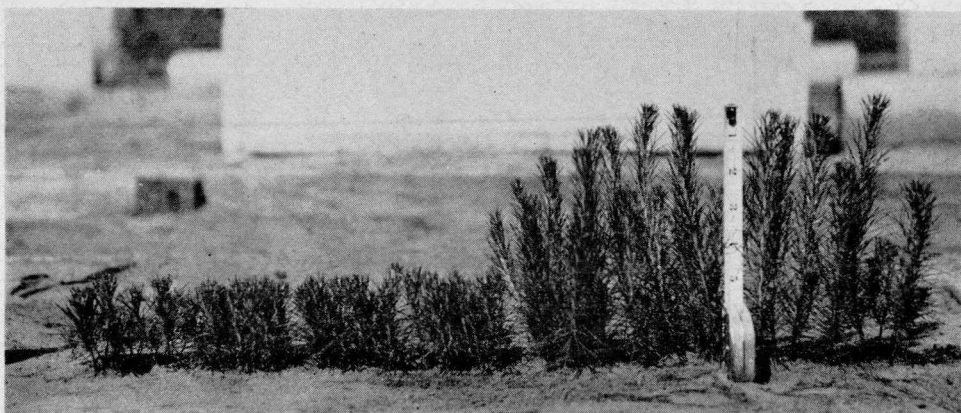


FIGURE 3. Red pine and jack pine seedlings at the start of the second growing season under a 6-hour daily exposure treatment. The difference in growth between the jack pine on the right and the red pine on the left is very marked.

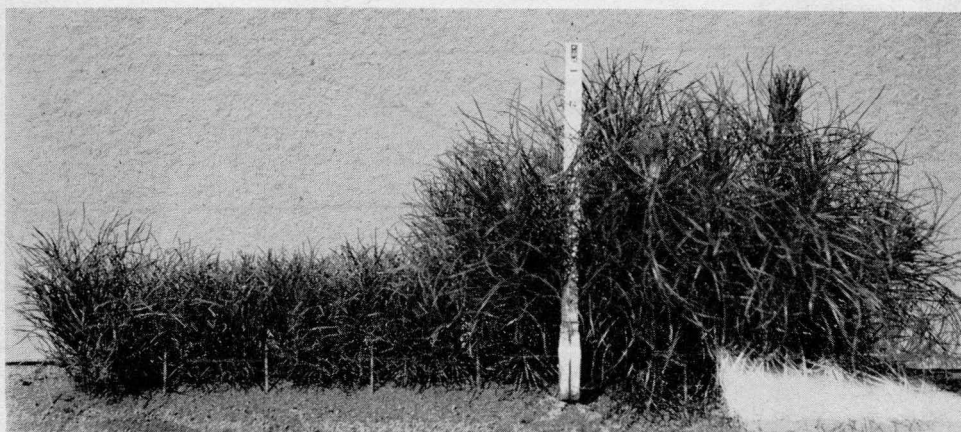


FIGURE 4. The same treatment shown in Figure 3, at the end of the second growing season. The growth differential is still very pronounced.

Such results were obtained in this experiment when the daily exposure to sunlight was 4 to 6 hours. The same period of exposure to sunlight could be obtained in clear-cut strips oriented north and south with a width of approximately two-thirds of the height of the bordering stand.

Obviously the conditions prevailing between the boards in this experiment and those in seedbeds on strip cuttings are not strictly analogous. Vegetation on the forest floor alone could lead to wide differences. The results, however, are suggestive. If suitable allowance is made for the local terrain and seedbed conditions, strip cutting might frequently be an appropriate method of reproducing red and jack pine.

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