CANADA

Department of Forestry

FOREST RESEARCH BRANCH

GERMINATION OF WHITE SPRUCE SEED AT LOW TEMPERATURE

(Picea glauca (Moench) Voss)

by

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Germination of white spruce seed during prolonged stratification at low temperature (about 40°F) was observed. A reasonable explanation for seemingly unusual behaviour is suggested by Allen's (1960) findings in work with Douglas fir (Pseudotsuga Menziesii (Mirb.) Franco) seed. Consequently the result, accidentally obtained with white spruce, takes on added interest.

A small amount of white spruce seed mixed with moist sterilized sand in a 10 ml glass beaker covered with a loose cap of aluminum foil was placed in a cold room (40°F) on February 10, 1961. Almost a year later, on January 31, 1962, the seeds were observed to be actively germinating.

The beaker was removed from the cold room and photographed after water had been added to the now dry sand to improve photo contrast (Fig. 1). Apparently normal germination was in progress, not only at the surface but throughout the mass of seeds and sand in the beaker. In fact, the contents of the beaker had been doubled by expansion of the embryos.

After being photographed the beaker was kept at room temperature (70°F) and light for a few days. Three changes took place which were taken to mean that the embryos were living and normal and that germination had begun fairly recently.

1) The contents of the beaker continued to expand and began to spill out.

2) After three days of exposure to light the embryos began to take on a green colour.

3) Embryos at the surface began to lean towards the light.

Further examination revealed 1) that radicles up to 6 cm long had developed and 2) that many seeds had not germinated. Some of the non-germinated seeds were filled and appeared to be normal while others were obviously incapable of germination but this was not investigated further.

Although the cold room where the seeds were stored is held automatically at 40°F the temperature is known to fluctuate. It increases when the door of the room is kept open to bring in or remove material but the changes are not recorded, so their magnitude and duration are not known. Normally the room is dark but from time to time it is illuminated for periods of varying length. Consequently, before germinating the seed spent almost a year at a generally low temperature, with occasional upward fluctuations, and was subjected to irregular periods of illumination.

In his work with Douglas fir seed Allen (1960) found that prolonged stratification (120 days) increased germination at low temperature(10°C or 50°F). He cites other reports of low-temperature germination and concludes that the phenomenon may be relatively common with conifers. It seems reasonable to suppose that the observed white spruce reaction resulted from a similar time-temperature relation.

It appears that a long period of stratification was necessary before the seed was capable of germination. Once this point was reached a rise in temperature may have acted as a stimulus to germination but until then similar stimuli had not been effective. Temperature changes are known to have taken place and it must be assumed that if they had any effect on the start of germination it was only after a long period of storage. Whatever the explanation, it seems that white spruce germination may resemble that of Douglas fir and some other conifers in being subject to control by pre-treatment.

Should the time-temperature relationship actually exist in white spruce it might have the same interesting applications as have been mentioned in connection with Douglas fir. In addition to these, it might, through control of germination, greatly contribute to improvement of results in reforestation by seeding. The effects of pre-treatment on germination of seed of all species used in reforestation in Eastern Canada might profitably be investigated.

REFERENCE

Allen, G.S. 1960. Factors affecting the viability and germination behaviour of coniferous seed. IV Stratification period and incubation temperature (Pseudotsuga Menziesii (Mirb.) Franco.) For. Chron. 36 (1): 18-29.

Figure 1.- Photograph (x2) of seed and beaker when removed from the cold room (40°F) after one year of stratification.