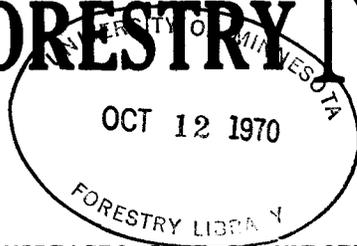


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ARTIFICIALLY EXTENDED PHOTOPERIOD INCREASES SIZE OF NURSERY STOCK

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Experimentation has shown that the diurnal variation of light and dark has an important effect upon the growth of woody plants. Generally, woody species, including most tree species tested, respond to long photoperiods (short nights) with a longer period of active growth throughout the season and greater heights than with short photoperiods (long nights). In heated greenhouses, most tree seedlings will grow throughout the year when placed under long photoperiods, giving much larger plants than those propagated under natural or short photoperiods.

In 1958 a trial was commenced in the Hugo Sauer Nursery, Rhinelander, Wisconsin,^{2/} to determine the response of conifers to 20-hour photoperiod. White and red pine and white and black spruce were selected for trial.

Stand collections of seed of the white and red pine and white spruce were made to reduce genetic variation; black spruce seed that was already available had to be used because of a poor seed year. All collections were from northern Minnesota and Wisconsin from about 45° N. to 47° N. latitude.

Stratified white pine, white spruce, and black spruce seeds, and untreated red pine seed were sown in duplicate groups in late April 1958 in drills 4 inches apart. Plants were thinned to give a stocking of approximately 40 plants per square foot.

One group was given 20-hour photoperiod produced by supplementary incandescent lighting at an intensity of 25 foot-candles at ground level. A time switch was used to regulate the lights in the evening and morning to give a dark period extending from 10 p.m. to 2 a.m. Natural effective photoperiod at the nursery reaches a maximum of nearly 17 hours at the summer solstice.

At the end of the first growing season, the white and red pine under long day were significantly taller than similar plants under natural day; white and black spruce were not significantly taller under long day.

At the end of the second season, the heights of red pine (but not white pine) and of both spruces were significantly greater under long-day treatment than under natural day. As seen in the accompanying graphs of average heights during second seasons, extended photoperiod clearly stimulated growth of the spruces greatly, so much so as to be of practical significance.

During the second season, white and red pine responded to long-day treatment with intermittent growth, setting terminal buds early in the season, and flushing late in the summer from these same buds. Both species under each treatment set terminal buds at the same time and relatively early in the season. Long-day treatment of white and red pine resulted in flushing of 93 and 77 percent respectively of the seedlings of these species; under natural photoperiod, only 14 and 22 percent

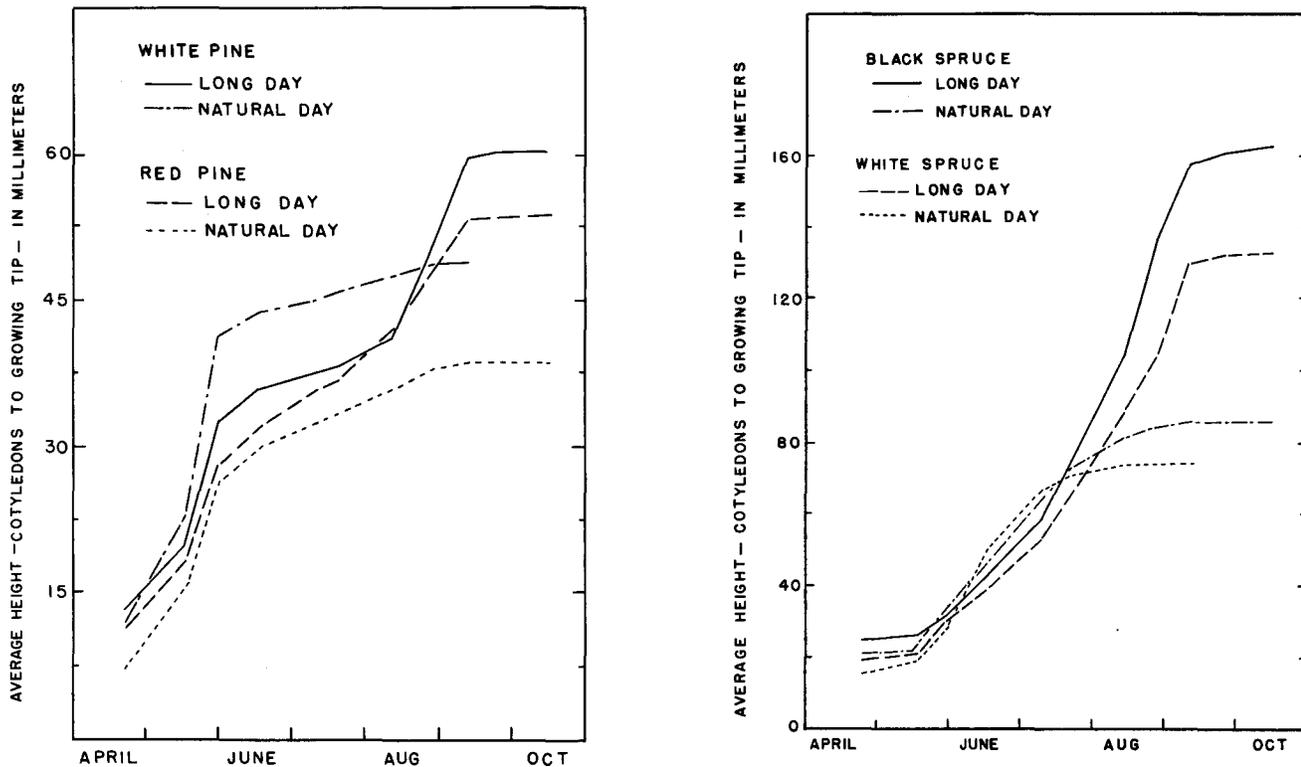
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^{2/} The cooperation of the Nursery Superintendent, Mr. Harold Berndt, was invaluable for the completion of this work.

produced a similar second flush. The additional height growth made by this flush is clearly visible on the height-growth graphs.

During the second season both spruces under long day grew without interruption until shortly after the long-day treatment was discontinued on August 27, 1959. This resulted in a doubling of height compared to heights under natural day. Although the supplemental lights were extinguished 4 weeks before the average date of first killing frost to allow time for the growing tip to harden off, an unusually early frost only 10 days after the ending of light treatment caused some slight damage to a small number of the plants.

Extended photoperiods during the second year of growth of white and black spruce may be of use in the production of nursery stock. Usually spruce are moved from the seedbeds to the transplant beds at the end of the second season for an additional 1 or 2 years' growth. At this time from 15 to 20 percent of the seedlings are discarded because of small size.^{3/} In the present trial only 5.6 percent of the white spruce in the long-day beds were below minimum heights for transplanting compared to 24.8 percent of the seedlings grown under natural day. Using the same specifications (no published standards are available for black spruce), only 1.8 percent of the black spruce under extended photoperiod were culls, compared to 15.9 percent of the plants in the natural-day bed. This reduction in the percent of cull of seedlings grown for transplanting should be of considerable value to the nurseryman, enabling him to increase his production of usable seedlings by about 15 percent without increase in bed area.



Average heights of four conifers during the second growing season under extended and natural photoperiod. Rhinelander, Wisconsin.

^{3/} Stoeckeler, J. H., and G. W. Jones. Forest nursery practice in the Lake States. U. S. Dept. Agr., Agr. Handb. 110, 124 pp., illus. 1957.