SUMMER AND FALL PLANTINGS OF JACK PINE IN ONTARIO SUFFER HIGH MORTALITY AND SLOWER HEIGHT GROWTH AFTER 15 YEARS

W. R. BUNTING and R. E. MULLIN, ***Ontario Department of Lands and Forests,*** **Maple, Ontario, Canada**

In 1951, jack pine was planted every 2 weeks, from May 2 to Oct. 18, at the Orono Nursery east of Toronto, Canada. The objective was to determine the various effects on survival and growth of seedlings planted at short intervals through the entire growing season (May to October). The results 15 years after planting are reported here.

Review of Literature

The effects of extending the planting season have been examined for species other than jack pine. Ackerman and Johnson (1) found that delaying the planning of white spruce until after May resulted in a low; survival and less height growth; the latter was evident 5 years after planting.

Crossley (3) also found that mortality increased in some years when white spruce were planted in the summer and that height growth decreased the third year after planting. Sissingh (12) reported that survival and height growth decreased when Douglas-fir was planted late. If only survival is considered,

best planting time for redcedar is before growth starts (2).

tone *et al. (13, 14)* showed a seasonal periodicity root-regenerating potential in Douglas-fir and ponderosa pine. The physiological conditions of the stock changed seasonally and were related to survival and growth.

Spring and fall planting have often been compared. Usually, planting in early spring, while the plants are still "dormant," is preferable *(5, 6, 7, 8)*. Rudolf (11), in a study of numerous plantations at least 20 years old, found that spring planting results in an average survival about 8 percent higher than fall planting.

Procedure

In the spring of 1951, a bed of 2-1 jack pine was selected at Orono Nursery, about 50 miles east of Toronto. At about 2-week intervals, beginning May 1, 100 trees were lifted and planted on property adjacent to the nursery. The trees were dug with garden forks.

The planting was in furrows by the wedge method (9) ; the trees were planted in rows of 50, at 4-by-4foot spacing. Rows were selected by random numbers for each of the 13 plantings, and there were two replications. The planting was usually done on the same day as the lifting, but occasionally, because of weather conditions, the trees were held in moss overnight.

Survival was measured at the end of the first growing season on Nov. 3, 1951. Survival and height of all living trees were measured again in April 1952 (table 1).

Result and Discussion

Mortality at the end of the first growing season seemed to indicate that fall planting had been almost as successful as spring planting, and that high mortality resulted only from planting done during July. However, the count after 15 years showed this assessment was unreliable. *The frequently expressed opinion that "if the trees survive the first year they will grow well" is not correct.*

The 1965 survival was analyzed for angular transformation (4), and the differences due to dates of planting were highly significant. Planting after the end of May had limited and varied success. Although trees planted in August, September, and October had very high first-year survivals, they suffered heavy mortality in later years (table 1).

Differences in height after 15 years were highly significant. The average height of trees planted after the end of May was about half a meter less than those planted earlier, a difference of about 10 percent.

TABLE 1. *Survival and height of jack pine at Orono Nursery, by date of planting*

Planting date (1951)	Survival at end of 1st growing season	Survival after 15th year [1]	Height after 15th year [2]
	Percent	*Percent*	*Meters*
May 2	98	89	6.06
May 16	99	98	6.04
May 30	100	98	6.03
June 14	72	67	5.32
June 27	83	77	5.66
July 11	30	24	5.71
July 25	54	51	5.60
August 8	95	78	5.65
August 22	100	54	5.65
September 5	100	41	5.35
September 19	100	61	5.33
October 4	100	63	5.24
October 18	100	63	5.24

[1] Significant at 0.1 percent level.
[2] Significant at 1.0 percent level.

Planting under adverse conditions had affected growth adversely and was still noticeable after 15 years. This finding agrees with the warning by Rowe (10) of the effects of environmental influences.

Records for soil moisture, temperature, and rainfall at the nursery showed no strong relationship between these factors and tree performance. The stage of growth or development at the time of lifting and planting was assumed to be of primary importance *(13, 14)*.

References

(1) Ackerman, R. F., and Johnson, H. J.
1962. Continuous planting of white spruce throughout the frost-free period. Canada Dep. Forest., Tech. Note 117, 13 pp.

(2) Afanasiev, M., Engstrom, A., and Johnson, E. W.
1959. Effects of planting date and storage on survival of eastern redcedar in central and western Oklahoma. Okla. Agr. Exp. Sta., Bull. B-527, 19 pp.

(3) Crossley, D. I.
1956. - The possibility of continuous planting of white spruce throughout the frost-free period.. Canada Dep. of Northern Affairs and Nat. Resources, Tech. Note 32, 31 pp.

(4) Fisher, R. A., and Yates, F.
1963. Statistical tables for biological, agricultural and medical research. Sixth Ed.. London Oliver and Boyd. 146 pp. (5)
Forestry Commission.
1958. Forestry practice. Forest Comm. London, Bull. 14, 93 pp.
(6) Horton, K. W., and Bedell, G. H. D.
1960. White and red pine ecology, silviculture and management. Canada Dep. of Northern Affairs and Nat. Resources, Bull. 124, 185 pp. (7)
Illinois Technical Forestry Association.
1957. Forest planting practices for Illinois. Springfield, Ill., 35 pp. (8)
Limstrom, G. A.
1963. Forest planting practice in the Central States. U.S. Forest Serv., Agr. Handb. 247, 69 pp.
(9) Mullin, **R. E.**
1964. Influence of planting depth on survival and growth of red pine. Forest. Chron. 40 (3) : 384391.
(10) Rowe, J. S.
1964. Environmental preconditioning, with special reference to forestry. Ecology 45(2) : 399-401
(11) Rudolf, P. O.
1950. Forest plantations in the Lake States. U.S. Forest Service, Tech. Bull. 1010, 171 pp.
(12) Sissingh, G.
1964. Planting time, vitality and physiological condition of Douglas-fir planting material. Forest Res. Sta. "De Dorschkamp", Netherlands 6(2) 67 pp.
(13) Stone, E. C., and Schubert, G. H.
1959. Root regeneration by ponderosa pine seedlings lifted at different times of the year. Forest Sci. 5(4): 322-332.
(14) Stone, E. C., Jenkinson, J. L., and Krugman, **S.** L.
1962. Root-regenerating potential of Douglas-fir seedlings lifted at different times of the year. Forest Sci. 8(3) : 288-297.