RESEARCH NOTE NC-70

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

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Development of White and Norway Spruce Trees from Several Seed Sources 29 Years After Planting

ABSTRACT. — A 29-year-old test of trees grown from seven white spruce and six Norway spruce seed sources and planted in Wisconsin and Minnesota demonstrates the importance of seed-source selection and indicates that trees from some Norway spruce sources equal or surpass the native white spruce.

OXFORD: 232.12(77):174.7 Picea abies + 174.7 Picea glauca

The spruces are important sources of pulpwood, but they have been planted much less widely than the pines in the Lake States. It was recognized early that there might be important intraspecies variation among spruces which could strongly affect planting success. Accordingly, in 1936 the Lake States (now North Central) Forest Experiment Station established a limited seed source study of white spruce (*Picea glauca* (Moench) Voss) and Norway spruce (*Picea abies* (L.) Karst.).

About The Study

Between 1928 and 1931, seeds were obtained representing seven sources each of white spruce and Norway spruce (only six sources of Norway spruce are discussed in this report, however) (table 1). The seeds were sown in the spring of 1932 in the Hugo Sauer Nursery of the U.S.D.A., Forest Service, near Rhinelander, Wisconsin. In the spring of 1936, the stock was lifted as 2-2 transplants and outplanted at five localities in Michigan, Minnesota, and Wisconsin. The trees were planted in 10-tree plots replicated 10 times at random except on the Nicolet National Forest in northeastern Wisconsin where all the available stock was set out in 100-tree plots with various numbers of replications.

Unfortunately, 1936 brought the most severe drought and summer temperatures on record in the Lake States. Mortality on most of the plantings was so great that no meaningful data could be obtained from them. The Nicolet planting, however, had been established under a partial overstory of aspen (*Populus tremuloides* L.) and suffered relatively low mortality. On the Superior National Forest, even though drought and heat were severe, enough trees remained to warrant further observations. Only these two plantations are considered here.

After some early damage by snowshoe hares, the Nicolet plantation was enclosed by a rabbit-proof fence in 1940. The planted spruces were given a series of releases ending in 1953 with the girdling of all remaining overstory trees. The Superior plantation was given no special aftercare. In September 1964, height, diameter, and survival were measured on 18 trees on each plot in the Nicolet plantation.

Measurements made on the Superior National Forest planting in northeastern Minnesota 19 years after planting are analyzed here for the first time.

NORTHEASTERN MINNESOTA

White spruce survival ranged from 23 to 44 percent (table 4) and was much lower than for trees from the same sources planted in northeastern Wisconsin. Most mortality occurred in the first year following planting. Stocking for most sources is less than desirable.

Trees from the Chippewa National Forest seed source made the best height growth but not signficantly more than the sources from Douglas, Ontario, and the Superior National Forest. The Custer, South Dakota, source was poorest in both mean height and diameter.

The Norway spruce survival was somewhat better than that of white spruce and ranged from 33 to 50 percent. Stocking was adequate for most seed sources.

Table 4. — Survival, mean height and d.b.h. of white spruce and Norway spruce seed sources 19 years after planting on the Superior National Forest, Minnesota

Seed source number	Survival	Height	D.b.h.
	Percent	Feet	Inches
WHITE SPRUCE			
255	41	14.7 a[1/]	2.2 a
257	45	14.5 a	2.2 a
039	27	14.4 a	2.2 a
256	26	12.9 b	1.8 ab
32-33	18	12.6 b	1.9 ab
270	27	10.4 b	1.4 b
Seed source F-value	NS	7.05	6.30
$S_{\bar{x}}$	--	.61	.13
NORWAY SPRUCE			
134	33	16.1 a	2.47 a
135	50	15.1 a	2.27 ab
137	50	14.7 ab	2.16 ab
132	45	12.3 bc	1.74 bc
138	42	11.7 c	1.73 bc
131	41	10.4 c	1.32 c
Seed source F-value	NS	16.46	10.96
$S_{\bar{x}}$	--	.54	.12

1/ Numbers followed by the same letter suffix (a, b, or c) do not differ significantly at the 5-percent level (Tukey's test).

There were significant differences in growth among the Norway spruce sources. Trees from Mozyr, White Russia, seed grew fastest in both height and diameter.

As was the case in Wisconsin the six fastest growing seed sources include three of white spruce and three of Norway spruce.

Conclusions and Recommendations

These rather limited studies of white spruce and Norway spruce indicate significant variations in height and diameter development due to seed source. The results with white spruce also indicate the necessity of considering plantation location when making seed-source recommendations.

For northeastern Wisconsin it appears that white spruce of some Ontario and Minnesota sources will equal or surpass stock from local sources. The faster growth of Ontario white spruce has also been indicated in more recent studies.[1]

In northeastern Minnesota, trees from local and other Minnesota sources of white spruce seem to be the best choices for planting based on development after 19 years in the field. Trees from the best Ontario sources, however, are not significantly poorer.

In both Wisconsin and Minnesota, it is also evident that Norway spruces of some White Russian origins will do as well or better than the best white spruce.

The results reported here give clues to the choice of spruce species and seed sources for planting in the northern Lake States. Recommendations must be qualified because of the limited number of seed sources and planting localities represented. Results should be brought into much sharper focus by the more comprehensive seed-source studies now underway.

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1969

[1] *Nienstaedt, Hans. 1968. White Spruce* (Picea glauca *(Moench) Voss) seed source variation and adaptation to 14 planting sites in northeastern United States and Canada. 16th N.E. Forest Tree Impr. Comm. Proc. (In press).*