Southern Appalachian hite Pine Off to a Good Start in the Midwest

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After 6 years in the field, eastern white pine *(Pinus strobus* L.) from the Appalachian Mountains in Tennessee, Georgia, and North Carolina has grown well wherever planted in the Midwest. Trees from Pennsylvania and Ohio seed have also done well. In contrast, Maine, Quebec, Minnesota, and Iowa seedlings have grown slowly wherever planted.

A cooperative provenance study of eastern white pine was begun in 1955 under the direction of the Northeastern Forest Experiment Station. Plantations were established in the Northeast, (Santamour, 1960) Southeast (Sluder, 1963) Lake States (Wright et al, 1963) and Midwest. In the Midwest the Central States Forest Experiment Station established plantings in Iowa, Illinois, Indiana, Ohio, and Kentucky; and the Ohio, Illinois, and Purdue Agricultural Experiment Stations made additional plantings in their states. This paper summarizes 5- and 6-year results from six of the plantations in the Central States.

Seed for the study was collected in 1956, and most of the seedlings were planted in 1958. A few were delayed until as late as 1960. In our Central States plantations we used seed from 16 sources representative of most of the range of eastern white pine from Minnesota, Ontario, and Nova Scotia to Tennessee, North Carolina, and northern Georgia (Table 1). Seed from 10 average trees was collected from each provenance.

Most of the white pine plantings in the Central States contain trees from all 16 sources, replicated 12 times in four-tree plots. Two exceptions are the Central States Station plantings in Iowa and southeastern Ohio where the sources are replicated four times in 81-tree plots. However, in this paper data from only 15 sources are considered; the trees from Michigan are omitted because they were planted a year later than the others.

Results

The white pine from the southern Appalachians has grown well in all the Central States plantations. Trees from these provenances took the top three rankings in total height in three of the plantations and accounted for two of the top three places in each of the other four plantings. In the six field locations for which I have detailed data, the average height of trees from Tennessee, Georgia, and North Carolina sources exceeds the overall average by from 22 to 38 percent. This advantage is similar to that reported by Wright and Sluder who found that southern Appalachian white pine grew to be 21 and 39 percent taller than the overall average in Michigan and North Carolina, respectively. I feel that this performance is meaningful and warrants consideration by practicing foresters as well as research workers, but I must emphasize that these rankings are based on trees only 8 years old from seed that have grown only five or six seasons in the field. Thus, these are preliminary results and must be interpreted with caution.

In six planting areas, height difference for trees from different seed sources were statistically very highly significant. Furthermore, Hartley's (Snedecor, 1956) multiple-range test shows that in all five of the Central States Station plantations, white pine from Tennessee, Georgia, and North Carolina was significantly taller than that from Maine and Minnesota (Table 2). Friedman's rank-correlation test (Friedman, 1963) also showed that the rather consistent ranking of the provenances in all plantings was highly significant (Table 3).

Survival was adequate for all sources, and we have found no cold-temperature damage to any of the trees in our southern Ohio plantations despite temperatures of —26° F. in January 1963, and —16° F. in January 1964. Other Midwestern plantations have also escaped winter damage (Wright et al, 1963 and Jokela, 1963).

Conclusions

White pine from the southern Appalachians has grown unusually well throughout the Central States for the first 5 or 6 years after planting.

Even though these trees are only 8 years old from seed, this consistently superior performance indicates a truly good prospect for planting eastern white pine from

southern Appalachian provenances in the Central States. These results at least justify further trials, using additional southern Appalachian seeds in larger plantations.

Table 1. Eastern white pine provenance description

Location	North latitude	West longitude	Elevation
			Feet
Union County, Georgia	34°46′	84°03′	2450
Greene County, Tennessee	36°00′	82°48′	2250
Pulaski County, Virginia	37°05′	80°50′	2400
Monroe County, Pennsylvania	41°05′	75°25′	1800
Franklin County, New York	44°25′	74°15′	1600
Penobscot County, Maine	44°51′	68°38′	150
Ashland County, Ohio	40°45′	82°15′	1000
Allamakee County, Iowa	43°28′	91°30′	1000
Cass County, Minnesota	47°23′	94°25′	1300
Forest County, Wisconsin	45°51′	88°54′	1500
Newaygo County, Michigan	43°30′	85°40′	600
Algoma District, Ontario	46°10′	82°37′	650
Pontiac County, Quebec	47°30′	77°—	1000
Lunenburg County, Nova Scotia	44°25′	64°35′	150
Transylvania County, North Carolina	35°14′	82°38′	2120
Greenbrier County, West Virginia	38°02′	80°30′	2600

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Table 2. Average height of eastern white pine by provenance after 5 to 6 years in six Midwestern plantations.

Carbondale, Illinois			Ames, Iowa			Athens, Ohio		
Source	Height	Hartley[2]	Source	Height	Hartley[2]	Source	Height	Hartley[2]
	(feet)			(feet)			(feet)	
Tenn.	6.67		Tenn.	2.98		Ga.	3.56	
Ga.	5.89		Ga.	2.93		Tenn.	3.31	
N. C.	5.73		Penn.	2.63		N. C.	3.07	
Ohio	5.56		W. Va.	2.38		Penn.	2.85	
Penn.	5.13		Ohio	2.33		Ohio	2.83	
W. Va.	5.00		N. C.	2.25		Wis.	2.47	
N. S.	4.89		N. Y.	2.25		Va.	2.35	
Wis.	4.62		Ont.	2.23		Ont.	2.31	
Va.	4.50		Va.	2.20		N. S.	2.30	
N. Y.	3.95		Wis.	2.10		W. Va.	2.28	
Minn.	3.54		N. S.	2.10		N. Y.	1.87	
Ont.	3.47		Que.	1.68		Minn.	1.86	
Iowa	3.44		Maine	1.65		Que.	1.72	
Que.	3.16		Iowa	1.60		Maine	1.70	
Maine	2.87		Minn.	1.58		Iowa	1.59	

Berea, Kentucky			Wooster, Ohio			Bedford, Indiana		
Source	Height	Hartley[2]	Source	Height	Hartley[2]	Source	Height	Hartley[1]
	(feet)			(feet)			(feet)	
N. C.	4.84		Ga.	3.17		N. C.	4.08	
Tenn.	4.44		Penn.	3.02		Tenn.	3.97	
Ga.	4.27		Tenn.	2.74		Penn.	3.80	
Penn.	4.09		Ohio	2.68		Ga.	3.71	
Ohio	3.95		N. C.	2.67		Ohio	3.62	
W. Va.	3.62		Wis.	2.34		Va.	3.18	
Va.	3.54		W. Va.	2.33		Wis.	3.17	
Wis.	3.49		N. S.	2.31		W. Va.	3.11	
N. S.	2.87		N. Y.	2.29		Iowa	2.60	
Ont.	2.61		Ont.	2.20		N. S.	2.42	
Que.	2.58		Minn.	1.97		Ont.	2.32	
N. Y.	2.56		Va.	1.97		N. Y.	2.26	
Iowa	2.48		Maine	1.89		Minn.	2.03	
Maine	2.23		Iowa	1.87		Maine	2.02	
Minn.	2.16		Que.	1.82		Que.	1.95	

[1] Vertical bars bracket sources not significantly different in height according to Hartley's multiple-range test.

Table 3. Height rank of trees from 15 eastern white pine provenances by plantation location

Source	Southern Illinois	Southern Ohio	Kentucky	Indiana	Northern Ohio	Iowa	Weighted rank[1]
Tennessee	1	2	2	2	3	1	11
Georgia	2	1	3	4	1	2	13
North Carolina	3	3	1	1	5	6	19
Pennsylvania	5	4	4	3	2	3	21
Ohio	4	5	5	5	4	5	28
West Virginia	6	10	6	8	7	4	41
Wisconsin	8	6	8	7	6	10	45
Virginia	9	7	7	6	12	9	50
Nova Scotia	7	9	9	10	8	11	54
Ontario	11	8	10	12	10	8	59
New York	10	11	12	11	9	7	60
Minnesota	12	12	15	13	11	15	78
Iowa	13	15	13	9	14	14	78
Quebec	14	13	11	15	15	12	80
Maine	15	14	14	14	13	13	83

[1] Sum of numerical rankings for all locations.