JACK PINE PROVENANCE TESTS IN MAINE [1]

by Katherine K. Carter, Assistant Professor of Forest Biology, University of Maine at Orono, ME 04469 and David S. Canavera, Genetics Project Leader, Westvaco Forest Research, Summerville, SC 29483.

ABSTRACT. Jack pine seedlings from 28 seed sources were planted at two locations in Maine in 1976 and 1977. In 1983, survival at both sites averaged 76 percent. Height varied significantly among provenances within each planting site. The correlation of provenance rankings between plantations was significant, but not high. Several seed sources from Michigan and Wisconsin demonstrated superior height growth at both sites.

The native range of jack pine (*Pinus banksiana.* Lamb.) stretches from Nova Scotia to the Mackenzie River valley in Canada, and southward into the Lake States region and northern New England. It has been widely planted in the Lake States, and provenance tests in that region and in Ontario have demonstrated the existence of substantial variation in growth rate, tree form, cold hardiness, and wood properties (Rudolph and Yeatman 1982). For Lake States plantations, height at age 10 was a good predictor of height at age 20 and could be used to develop seed source recommendations on all but the coldest sites (Jeffers and Jensen 1980).

Jack pine is being widely planted in New Brunswick, where an intensive selection and breeding program has been underway since 1976 by the New Brunswick Tree Improvement Council. Because of its rapid juvenile growth rate the species has also generated interest in Maine, where it is being included in some industrial seed orchards (Colgan 1983). No provenance test results have been available for the state, however. Such information would be useful in deciding what, if any, nonlocal seed sources should be considered for inclusion in seed orchards and planting programs for this region.

METHODS

Seed from 28 provenances of jack pine was obtained from C. W. Yeatman and Ben Wang, Petawawa Forest Experiment Station, and from Richard Jeffers of the North Central Forest Experiment Station, Rhinelander, Wisconsin. All provenances were from the southern and eastern portions of the species range (Table 1). Seeds were sown in Tinus Rootrainers in two lots for planting in subsequent years. The first seedlot was sown in the University of Maine forestry greenhouse in

---

[1] This research was supported in part by the Cooperative Forestry Research Unit and McIntire-Stennis grant No.39610 of the Maine Agricultural Experiment Station. CFRU Journal Article Series No. 46.

the spring of 1975 and wintered over in the nursery area until planted in July 1976 at Dyer Township, Maine. The second seedlot was sown in the greenhouse in February 1977 and outplanted at Deblois, Maine, in July of the same year. Seedlings were approximately ten inches tall when planted. Both planting sites are located in eastern Maine, approximately 55 miles apart and at about 400 ft. above sea level. Latitudes of the planting sites are 45° 45' (Deblois) and 45° 20' (Dyer).

The experimental design at both sites consists of 4-tree row plots in a randomized block design with 7 (Dyer) or 9 (Deblois) replications. The Dyer site is on a somewhat poorly drained clearcut area while the Deblois plantation is located on a sandy site, a former blueberry barren which had been burned prior to planting. Roundup® was applied to both sites during the summer of 1977 to control competing vegetation.

In the summer of 1978, dead trees at both sites were replaced by new seedlings. These replacements are included in measurements at Deblois, but are not included in the following analyses for the Dyer site since they are two years younger than the original trees at that site.

Total height of trees in both plantations was measured at the end of the 1980 and 1983 growing seasons. Average growth over the three-year period was obtained by subtraction. Correlations based upon provenance means were used to compare the performance of provenances over time and at different locations. Analyses of variance were used to test for significance of variation.

RESULTS AND DISCUSSION

Trees at Dyer averaged 4.0 feet tall after 5 years in the field while those at Deblois averaged 2.7 feet after 4 growing seasons. By the end of 1983, after three more years in the field, the average heights had increased to 9.3 feet and 6.7 feet, respectively. Height differences among provenances were significant at the 1% level at Deblois, and at the 8% level at Dyer (Table 2). The tallest provenance at each site was 10% to 13% above the plantation mean, while the shortest was 22% to 15% below average (Table 3). This is similar to the magnitude of variation observed in provenance tests in Nebraska and in the Lake States (Sprackling and Read 1975; Jeffers and Jensen 1980; Canavera 1973). Survival in 1983 averaged 76% at both sites. Differences in survival among provenances within each site were small.

No local seed sources were included in these plantations, but two New Brunswick provenances from 150-200 miles east of the Dyer site are represented. Both New Brunswick provenances were below average in height in the Maine plantations and had average survival rates. In general, trees from Michigan and Wisconsin were superior at both sites, although a few other provenances were outstanding at a single site.

Latitude of the seed source was an important factor at Dyer, where 10 of 13 provenances from north of 46 latitude were below the plantation average. Only 7 of the 13, however, were shorter than average at Deblois.

Table 1. Seed source locations and identification numbers for jack pine in University of Maine provenance tests.

U. Maine #	Other ID#[1]	Locality	N.Lat.	W.Long
139	PFES 5.3268 LS 2231	Waupaca, Wisc.	44°20'	89°
140	PFES 5.3270 LS 2233	Nokomis, Wisc.	45°34'	89°47'
141	PFES 5.3273	Marl Lake, Mich.	44°31'	84°43'
142	PFES 73006	Petawawa Plains, Ont.	45°57'	77°27'
143	PFES 70047	Hauterive, Que.	50°10'	68°35'
144	PFES 70050	Northumberland Co. N.B.	46°30'	66°00'
145	PFES 68007	Sioux Lookout, Ont.	50°00'	92°00'
146	PFES 68009	Highview, Ont.	45°57'	77°27'
147	PFES 70032	Timmins, Ont.	48°	82°
148	PFES 70033	Greenlaw Twp., Ont.	47°30'	83°
149	PFES 70034	Longlac, Ont.	49°45'	87°
150	PFES 70035	Nipigon, Ont.	49°	88°30'
151	PFES 70038	Princess Park, N.B.	46°	66°10'
152	PFES 70043	Atikokan, Ont.	48°45'	91°50'
153	PFES 70045	Gibi Lake, Ont.	49°	94°
154	PFES 70046	Pontiac Co., Que.	46°10'	76°10'
155	PFES 70180	Petawawa Plains, Ont.	45°57'	77°27'
156	PFES 73132	Kenora, Ont.	49°30'	94°30'
157	PFES 73142	Thessalon, Ont.	46°20'	83°30'
158	PFES 5.3275	Gladstone, Mich.	46°	86°30'
502	PFES 5.3271 LS 2234	Freesoil, Mich.	43°55'	86°25'
503	PFES 5.3283 LS 2246	Hadashville, Manit.	49°30'	95°45'
504	LS 4109	Oneida Co., Wisc.	45°50'	89°20'
505	LS 4110	Oneida, Wisc. (windbreak trees)	45°38'	89°23'
506	NC 4875	Hayward, Wisc. (Hayward State Nursery)	46°05'	91°25'
507	NC 5150	Ottawa N.F., Mich. (Toumey Nursery)	46°30'	89°
508	NC 7295	Cassian area, Wisc.	45°40'	89°50'
509	NC 7738	Fife Lake, Mich.	44°31'	85°23'

[1] PFES = Petawawa Forestry Exp. Sta.
LS = Lake States
NC = North Central

Table 2. Analysis of variance for 1983 height of jack pine provenance tests at Deblois and Dyer Twp., Maine.

Source of variation	Dyer df	Dyer MS	Dyer pr>F	Deblois df	Deblois MS	Deblois pr>F
Provenance	27	5.247	0.08	27	5.964	0.01
Replication	6	27.557	0.01	8	14.316	0.01
Error	537	3.727		681	2.333	

Table 3. Relative height of 28 seed sources of jack pine in two Maine plantations, at the end of the 1983 growing season.

State or Province	UMFG Seedlot#	percent of Plantation Mean Height Dyer	Deblois
Manitoba	503	110	95
Michigan	502	109	108
Michigan	141	105	98
Michigan	507	104	107
Wisconsin	505	104	110
Wisconsin	506	104	106
Wisconsin	140	104	94
Wisconsin	139	103	113
Michigan	509	103	107
Ontario	153	103	96
Ontario	142	103	94
Wisconsin	508	102	110
Ontario	146	102	105
Ontario	149	102	90
Ontario	155	101	94
Ontario	152	100	101
Wisconsin	504	100	102
Michigan	158	99	106
Ontario	147	98	105
Ontario	157	98	102
New Brunswick	151	98	100
Ontario	148	97	98
Quebec	154	97	93
Ontario	156	93	102
New Brunswick	144	93	98
Ontario	150	93	93
Ontario	145	92	102
Quebec	143	85	78
Plantation Mean Ht. (ft.)		9.3	6.7
Range of Provenance Means (ft.)		7.9 - 10.2	5.2 - 7.5
Age (years)		8	7

There are significant correlations between height in 1980 and 1983 at both sites, and also between the two sites (Table 4). The site-to-site correlation for 1983 height, while significant, is fairly low (r=0.52) and an examination of Table 3 indicates that the performance of some provenances changed greatly. Six provenances, however, are in the top 33% for height at both sites. These are numbers 139, 502, 505, 506, 507 and 509, all from Michigan and Wisconsin.

Table 4. Pearson correlation coefficients (r) for height of jack pine provenances at two plantations in 1980 and 1983, and for 1980-1983 growth increment.

	Dyer			Deblois	
	Growth	1980	1983	Growth	1980
1983	0.31*	0.32*	0.52**	0.86**	0.91**
1980	NS	0.39*	0.51**	0.58**	
Growth	0.34*	NS	0.40*		
1983	0.57**	0.64**			
1980	NS				

*significant at 0.10 level!
**significant at 0.01 level;

These data indicate that provenance differences in growth rate are significant for jack pine planted in Maine. Site x provenance interactions are also significant and would probably be larger if the plantations had been located in more diverse climatic areas of the state. Additional tests should be established to include more local seed sources as comparisons and to assess the performance of non-local seed sources when planted in the northern and western portions of the state.

LITERATURE CITED

Canavera, D.S. 1973. Results of a 4-year provenance test of jack pine conducted in Michigan. Mich. State Univ. Ag. Expt. Sta. Nat. Res. Rep. No. 204. 7p.

Colgan, T.J. 1983. Selection of jack pine in western Maine. Northeast. For. Tree Impr. Conf. Proc. 28: 158-162.

Jeffers, R.M. and R.A. Jensen. 1980. Twenty-year results of the Lake States jack pine seed source study. USDA For. Serv. Res. Pap. NC-181. 20p.

Rudolph, T.D. and C.W. Yeatman. 1982. Genetics of jack pine. USDA For. Serv. Res. Pap. WO-38. 60p.

Sprackling, J.A. and R.A. Reed. 1975. Jack pine provenance study in eastern Nebraska. USDA For. Serv. Res. Pap. RM-143. 8p.