

FIFTEEN-YEAR RESULTS OF A LIMITED RANGE  
EASTERN LARCH SOURCE STUDY 1/

Franklin C. Cech, Roy N. Keys and Brent  
W. Frenchak. Professor of Forest Genetics,  
Research Technologist and Senior, Division  
of Forestry, West Virginia University,  
Morgantown, WV respectively.

ABSTRACT -- Seedlings from the NC-51 Eastern larch seed source study were planted on three sites in northern West Virginia. In an earlier report, seventh year results were presented for one of the three plantations. This report includes an evaluation of all three plantings at 15 years of age. The low elevation planting (1100 ft) had very poor survival and no measurements were taken. Results from the two high elevation plantings (2300 ft) are presented and recommendations are made for sources that are suitable for planting in this area.

In previous report (Cech, et al, 1977) we discussed the survival and growth rate of trees from sixteen seed sources growing on one plantation on the West Virginia University Forest. Seedlings for this study were grown from seed collected by Pauley for the NC 51 Regional Project (Pauley, 1964), and the seedlings were made available to the authors by Jonathan Wright at Michigan State University.

Tamarack [Larix laricina (Du Roi) K. Koch] has an extensive natural range, occurring widely in the boreal and northern forest regions. It grows as far south as the Cranesville Swamp in West Virginia at an altitude of 2250 feet. Usually, especially in its southern extremes, it is a tree associated with bogs and swamps. In its northern range it grows on drier sites (Roe, 1957).

Pauley's study had for two of its objectives, "to provide information on the range and pattern of genetic diversity in this widely distributed, but little known native species of Larix," and "to isolate the best adapted sources for plantation culture and for the establishment of breeding aboreta."

We were also interested in these objectives and in May, 1967 established three small plantations with 16 sources each with the limited number of seedlings available (Table 1). The largest of these was located on the WVU forest at Cooper's Rock State Forest at an elevation of 2300 feet on a relatively flat site, protected on all four sides by a mature cove hardwood stand. The site index for oak is 75. Six replications were planted with four tree linear plots on an 8 by 8 foot spacing.

A second plantation of two replications was established on the WVU Division of Forestry Farm Woodlot located just north of Morgantown at an elevation of 1100 feet on a southeast facing slope, again with four tree linear plots, but on a 6 by 6 foot spacing. Survival on the woodlot site was so poor

---

1/ Partially funded by McIntyre Stennis funds.

Published with the approval of the Director of the West Virginia Agriculture and Forestry Experiment Station as Scientific Article #1825 .

that no measurements were ever taken. The site is apparently at an elevation and aspect such that larch was unable to become established. After this plantation was abandoned, the area was overgrown with volunteer species, especially black locust and various shrubs species. In the past year, however we have noticed four or five larch which survived the first years and are now appearing above the understory. These seem to be growing well at this time.

Table 1. Location of Tamarack Seed Source

Source No.	County, State	Latitude (N)	Longitude (W)	Elevation (Ft.)
11	Washington, WI	43°10	88°0	980
12	Washburn, WI	46°0	91°45	1100
13	Carver, MN	45°0	93°45	750
17	Waukesha, WI	43°0	88°15	820
20	St. Louis, MN	47°53	91°51	1421
21	Anoka, MN	45°05	93°00	
22	Itasca, MN	47°10	93°28	
24	Richland, WI	43°15	90°20	1000
27	Eau Claire, WI	44°45	91°0	
47	Sawyer, WI	46°0	91°30	1196
50	Van Buren, WI	42°10	86°08	775
52	Cass, MI	41°52	85°57	840
55	Clare, MI	44°0	85°0	
56	Shiawassee, MI	42°49	84°21	
64	Ontario	49°28	82°16	750
65	Kalamazoo, MI	42°23	85°22	840

The third plantation consisting of three replications was established on an open meadow on a southwest facing slope of Mount Zion, approximately 60 miles southeast of Morgantown at an elevation of 2300 feet. Spacing on this plantation was 6 by 8 feet. The plantation on Mount Zion suffered from the exposed site and heavy snowfalls. The small seedlings were twisted and had poor form. Early growth was very slow. The surviving trees have, in general, recovered and are growing well.

The West Virginia University forest and Mount Zion plantations were evaluated in September and October of 1981. Survival, dbh to the nearest 0.1 inch and height to the nearest 0.1 foot were recorded. Measurements were converted to the metric system for analysis. The data were analyzed using a general linear model procedure. Linear regressions were performed using all data in comparison to latitude, longitude, and elevation at the seed source. Correlations between 1973 and 1981 height and diameter measurements were also determined.

Table 2. Height and DBH by source.

Source Number	Location	Average Height ± S.D. (cm)	Average DBH ± S.D. (cm)
52	Cass, MI	877 ± 191 a*	10.3 ± 3.4 a
56	Shiawassee, MI	877 ± 204 a	8.7 ± 2.7 abc
21	Anoka, MN	862 ± 209 ab	9.4 ± 2.6 ab
55	Clare, MI	833 ± 203 ab	9.6 ± 3.3 a
24	Richland, WI	818 ± 209 abc	9.6 ± 2.9 ab
11	Washington, WI	817 ± 195 abc	9.0 ± 2.8 abc
50	Van Buren, MI	806 ± 279 abc	9.3 ± 4.2 ab
65	Kalamazoo, MI	786 ± 226 abc	8.8 ± 3.3 abc
22	Itasca, MN	767 ± 195 abc	7.5 ± 2.5 bcd
27	Eau Claire, WI	763 ± 203 abcd	8.6 ± 3.1 abcd
13	Carver, MN	728 ± 223 bcd	7.0 ± 3.0 cde
17	Waukesha, WI	693 ± 219 cd	7.0 ± 3.2 cde
47S	Sawyer, WI	681 ± 242 cd	7.0 ± 3.4 cde
20	St. Louis, MN	679 ± 146 cd	7.2 ± 2.0 cd
12	Washburn, WI	633 ± 168 de	6.5 ± 2.2 de
64	Ontario	513 ± 199 e	5.0 ± 2.8 e

\* Values with the same letter are within the same LSD group at the 0.01 level of significance.

#### RESULTS

The overall average height, dbh, and percent survival were 763 cm (25.0 ft), 8.3 cm (3.3 in), and 68.47, respectively. Differences among sources were significant at the 0.01 level for height and dba (Table 2), and at the 0.05 level for percent survival (Table 4). There was a large variation within sources for height and dbh.

There was a significant inverse correlation of height ( $r = -0.39547$ ) and dbh ( $r = -0.48159$ ) to latitude of the seed source at the 0.01 level. Height and dbh were not correlated to either longitude or elevation of the seed source. Survival was not correlated to latitude, longitude, or elevation of the seed source. Height in 1981 was correlated to height in 1973 at the 0.01 level ( $r = 0.97$ ). Dbh in 1981 was correlated to dbh in 1973 at the 0.01 level ( $r = 0.89$ ).

Mean height at the WVU Forest (831 cm) was significantly greater at the 0.01 level than mean height at Mt. Zion (577 cm). Average dbh and percent survival at the WVU Forest (8.7 cm and 74.7%, respectively) were significantly greater at the 0.05 level than at Mt. Zion (7.0 cm and 55.3%, respectively). There were no significant site x source interactions for either height or dbh. There were site x source interactions for percent survival at the 0.01 level of significance for 2 sources and at the 0.05 level of significance for 4 sources (Tables 3 and 4).

Table 3. Dbh and total height by source and site.

Accession Number	Source	AVERAGE DBH				AVERAGE HEIGHT			
		W.V.0 cm	forest (in)	Mt. Zion cm	(in)	W.V.U. cm	forest (in)	Mt. Zion cm	(in)
52	Cass, MI	10.20	(4.02)	10.70	(4.2)	895	(29.3)	801	(26.3)
21	Anoka, MN	10.0	(3.9)	7.8	(3.1)	947	(31.1)	620	(20.3)
55	Clare, MI	9.9	(3.9)	9.1	(3.6)	919	(30.1)	674	(21.2)
11	Washington, WI	9.8	(3.9)	7.2	(2.8)	908	(29.8)	625	(20.5)
24	Richland, WI	9.7	(3.8)	9.3	(3.7)	883	(29.0)	702	(23.0)
65	Kalamazoo, MI	9.5	(3.7)	6.9	(2.7)	860	(28.2)	564	(18.5)
50	Van Buren, MI	9.4	(3.7)	9.0	(3.5)	888	(29.1)	594	(19.5)
56	Shiawassee, MI	9.2	(3.6)	5.7	(2.2)	927	(30.4)	521	(17.1)
27	Eau Claire, WI	8.9	(3.5)	7.2	(2.8)	806	(26.4)	560	(18.4)
47	Sawyer, WI	8.3	(3.3)	4.0	(1.6)	799	(26.2)	396	(13.0)
17	Waukesha, WI	8.0	(3.1)	5.4	(2.1)	788	(25.9)	527	(17.3)
13	Carver, MN	7.9	(3.1)	4.1	(1.6)	818	(26.8)	456	(15.0)
22	Itasca, MN	7.8	(3.1)	5.9	(2.3)	813	(26.7)	524	(17.2)
20	St. Louis, MN	7.5	(3.0)	6.6	(2.6)	743	(24.4)	550	(18.0)
12	Washburn, WI	7.2	(2.8)	5.3	(2.1)	708	(23.2)	483	(15.8)
64	Ontario	5.3	(2.0)	3.6	(1.4)	547	(17.9)	359	(11.7)
	Mean	8.7		7.0		831		577	



