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VARIATION IN BARK THICKNESS OF JACK PINE SEED SOURCES

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The radial growth of trees can readily be separated into components, i.e., radial growth of wood, and radial growth of bark. Generally, the two components are closely associated[2] so that a regression relationship, often linear, can be used to relate the two variables. Due to a variety of reasons, however, enough differences exist that individual trees or groups of trees, e.g., seed sources of differing genetic composition, may have quite different rates of growth of wood and bark. Bark thickness has seldom been studied in seed source trials, but in one reported study from Germany[3] bark thickness among nine seed sources of *Pinus sylvestris* varied from 9% to nearly 16% of the diameter o.b., at 25 years. Translated into volume, the study showed that of the two sources, one source had actually 15% more wood than the other although based on o.b. measurements the trees had the same volume.

This report examines the bark thickness (BT) and BT-DBH relationships among 25 seed sources of jack pine, 18-21 years old, growing in a plantation, previously described[4], at Cloquet, Minnesota. The sources are grouped into two series of plots which lie adjacent on a uniform site. DBH was measured to the nearest 0.1 inch by diameter tape. Double BT at BH was measured to the nearest 0.01 inch by two readings (on the N-facing and S-facing side of each tree) of the Swedish Bark Gauge. Badly suppressed, diseased, and strongly leaning trees were not measured. The data from the two series of plots were pooled and are shown in the Table. Emphasis was placed on the relationship, expressed as a regression equation, between BT and DBH. T-test comparisons were made for each pair of regression coefficients. The highlights are:

1. Small regression coefficients are associated with thin-bark trees since the increase in BT with increasing DBH is relatively small. Conversely, large regression coefficients are associated with thick-bark trees as there is a rapid buildup in BT with increasing DBH.

2. Comparison of regression coefficients by the t-test showed nine significant groups. The groups are entirely overlapping, however, thus showing the continuous nature of the variation.

3. Since the trees are young, meaningful BT differences may not yet be established. Nevertheless several strong trends are indicated, viz., (a) thick-bark trees are practically limited to sources from the S and W portions of the Lake States; (b) thin-bark trees are mostly found in sources originating in the far N and on the E coast; (c) BT of sources from Minnesota declines rapidly and quite uniformly from the SW to the NE thus confirming an earlier report[5]; (d) BT of sources from Michigan declines rapidly from S to N. (Fig. 1 and 2).

4. There is considerable tree to tree variation in BT that is not accounted for by the regression. This suggests that there are inherent differences in the rate of growth of bark and wood in all areas.

5. The data suggest that BT is a trait under moderately strong genetic control. Therefore, the thickness of bark is primarily an adaptation by the species to local environments in which climate, soils, photoperiod, and fire all may play a part. Practically the data also suggest that selective breeding for thin-bark or thick-bark trees might be feasible.

Since it is not known whether the original material represents a random selection from a geographic source, caution must be exercised in interpreting and applying the results.

1/ Assistant Professors, School of Forestry, University of Minnesota.
2/ Bruce, D. and F. X. Schumacher. 1935. Forest Mensuration. McGraw-Hill, New York. p. 185.
3/ Vanselow, K. 1934. Allg. Forst. Jagdztg. 110: 257-258.
4/ Schantz-Hansen, T. and R. Jensen. 1954. Minnesota Forestry Note 25.
5/ Gevorkiantz, S. and L. Olsen. 1955. U.S.D.A. Tech. Bull. 1104.

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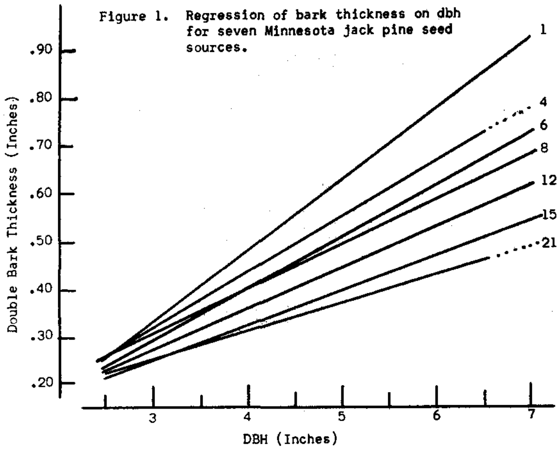

Figure 1. Regression of bark thickness on dbh for seven Minnesota jack pine seed sources.

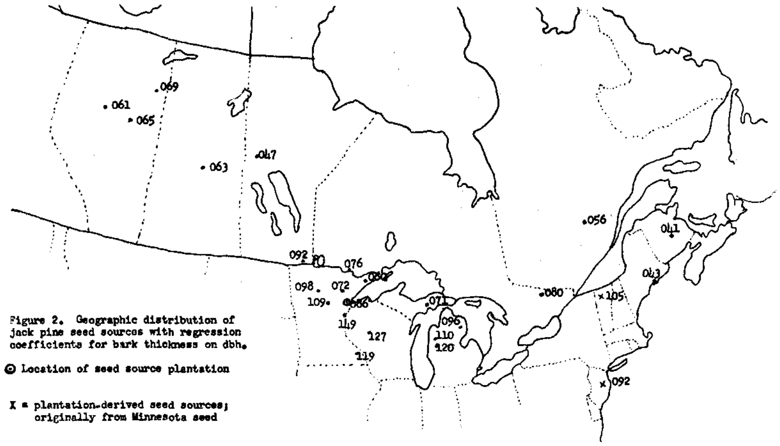

Figure 2. Geographic distribution of jack pine seed sources with regression coefficients for bark thickness on dbh.

⊙ Location of seed source plantation

X = plantation-derived seed sources; originally from Minnesota seed

Table. Bark thickness of 25 jack pine seed sources at Cloquet, Minnesota.

No.	Seed Source	Number of Trees	Mean Bark Thickness at BH Inches	Linear Regression Equation 1/ Form: Y = a + bX 6/	"t" Tests 2/ for Regression Coefficients 5% level	Percent Variation Attributable to Regression
1	Hinckley, Minnesota	44	.520	-.1162 + .14897X	*	80.8
2	Eau Claire, Wisconsin	24	.373	-.0208 + .12652X	**	66.2
3	Baldwin, Michigan	86	.445	-.0555 + .11996X	*	65.8
4	Peterson, Minnesota	42	.456	-.0427 + .11914X	*	84.1
5	Wellston, Michigan	312	.451	-.0271 + .11041X	*	71.8
6	Jenkins, Minnesota	516	.452	-.0337 + .10913X		70.2
7	Burlington, Vermont 3/	42	.422	-.0020 + .10457X		70.3
8	Park Rapids, Minnesota	455	.437	.0054 + .09768X		64.0
9	Huron, Michigan	410	.456	.0222 + .09639X	*	61.2
10	Sandilands, Manitoba	42	.365	-.0189 + .09241X	* *	76.7
11	Bass River SF, N.J. 3/	48	.466	.0500 + .09182X	*	72.4
12	Cloquet, Minnesota	2015	.371	.0132 + .08645X		67.0
13	Chalk River, Ontario	45	.306	-.0299 + .08000X	* *	77.9
14	Fort Frances, Ontario	39	.349	.0242 + .07563X	*	69.8
15	Chisholm, Minnesota	343	.348	.0386 + .07186X		70.0
16	Manistique, Michigan	440	.325	.0073 + .07136X		66.4
17	McMurray, Alberta	40	.266	.0491 + .06886X	*	52.1
18	Smith Landing, Alberta	35	.286	.0766 + .06499X		56.3
19	Regina (?), Sask.	32	.269	.0637 + .06284X		66.1
20	Iroquois Lake, Alberta	19	.257 4/	.1006 + .06096X	* *	24.5
21	Grand Marais, Minnesota	400	.324	.0741 + .05985X		70.4
22	Lake St. John, Quebec	35	.266	.0499 + .05598X		64.7
23	The Pas, Manitoba	38	.256	.0952 + .04719X		31.1
24	Bar Harbor, Maine	20	.241 5/	.1386 + .04310X	*	29.2
25	Miramichi, New Brunswick	34	.290	.1379 + .04093X	*	54.0

1/ Computed with diameter o.b. and double bark thickness scaled in inches.
2/ Sources not connected by a straight line have significantly different regression slopes.
3/ These sources were derived originally from Minnesota seed.
4/ Measured at 3 feet.
5/ Measured at 2 feet.
6/ Y = Double bark thickness; X = Diameter o.b.

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