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A RELATIONSHIP BETWEEN SCION BUD ORIGIN AND GROWTH OF WHITE PINE GRAFTS^{1/} Clifford E. Ahlgren^{2/}

Young grafts of Eastern white pine (*Pinus strobus* L.) frequently develop plagiotropic (non-erect) growth. Such growth could be related to the original position of scion wood on the parent tree or to competition for light and growing space. An investigation of this problem was established at the Quetico-Superior Wilderness Research Center, Basswood Lake, northeastern Minnesota.

Scions from main-terminal, lateral-terminal, and lateral-lateral bud origins of five year old wilding white pine were grafted to white pine of similar age in a thick, natural stand shaded by a dense overstory of mature white pine. Additional grafts were made on planted stock on a similar site cleared to eliminate shading and competition. Scions for the latter site were obtained from a mature white pine.

On each site, side slit grafts were made using 30 scions from each bud origin. All grafts were made two inches above the root collar. At the end of the first growing season rootstock tops were removed by pruning to one inch above the graft union. After nine growing seasons, 81% of the grafts survived, reducing the sample size slightly.

To measure scion growth deviation from the erect position, the following values were assigned:

- (1) Erect or forming a 0 to 17 degree angle from the vertical = angle value 1;
- (2) Forming a 18 to 35 degree angle from vertical = angle value 2;
- (3) Forming a 36 to 53 degree angle from vertical = angle value 3;
- (4) Forming a 54 to 71 degree angle from vertical = angle value 4;
- (5) Forming a 72 to 90 degree angle from vertical = angle value 5.

Beginning two years after grafting, angle values of each graft for seven consecutive years were totalled and the mean seven-year angle value of all grafts in each bud origin category (main-terminal, lateral-terminal, lateral-lateral) was obtained. Ungrafted trees of the same age and size grown on the same sites were used as control. The Kolmogorov-Smirnov Test (Walker, Helen M. and Joseph Lev. 1953 Statistical Inference. Holt, Rinehart, Winston, Inc., New York, pp. 426-428) was used to determine significance at the 95% level. Growth in height was also recorded. Twenty-five plants of each category were used.

Mean angle values are given in Figure 1. The same trends were apparent on both sites, although differences were greater for young scions grown on the shaded site. In both cases, the grafts of lateral-lateral bud origin were significantly less erect than the ungrafted controls. Other differences were significant only for the young scions on the shaded site. Here, ungrafted controls were significantly more erect than scions of lateral-terminal and lateral-lateral bud origin. The main-terminal scions were significantly more erect than those of lateral-lateral origin. Frequently, scions, especially those of lateral-lateral and lateral-terminal bud origin, reversed their direction of angling resulting in a zig-zag stem (Figure 2).

These data suggest that the bud origin of the scion influences the mode of growth after grafting. Buds from a main-terminal position which normally would produce erect growth in the ungrafted state tend to continue that mode after grafting, at least for seven years. Buds from the lower portion of the crown where horizontal or angled growth would be expected tend to continue that mode of growth after grafting.

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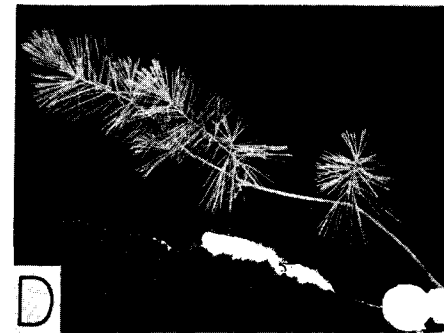
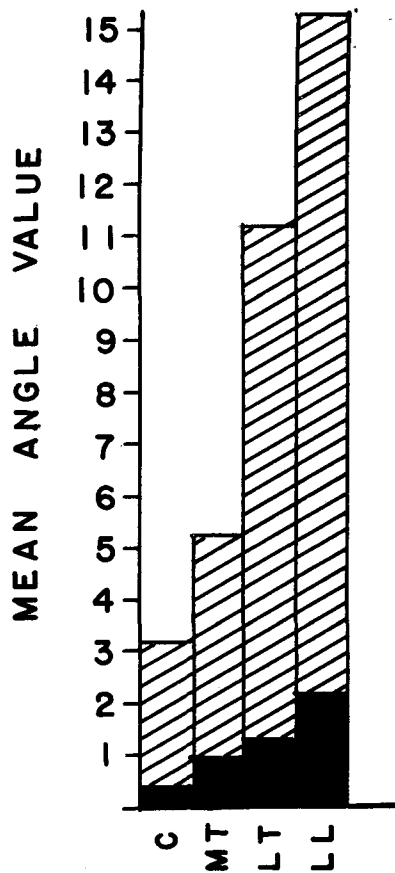


Figure 1. Comparison of mean 7-year angle value for controls (C), scions of main-terminal (MT), lateral-terminal (LT), and lateral-lateral (LL) bud origin. The solid portion of each bar represents the angle value for controls or grafts of older scions on an open site. The entire bar represents the angle value for controls or scions grafted from young trees on a shaded site.

Figure 2. A: ungrafted control showing erect growth. B: graft of main-terminal bud origin. C: graft of lateral-terminal origin. D: graft of lateral-lateral bud origin.

The growth in length of grafted trees was very similar on both sites (Table). Apparent differences between growth of scions of main-terminal origin and growth of scions of lateral-terminal and lateral-lateral bud origin are not statistically significant. Growth of ungrafted controls on the open site was significantly greater than that of the controls on the shaded site. The unpruned condition coupled with additional light and lack of competition undoubtedly were factors here.

TABLE

Mean 7-year growth in length of grafts and controls. Each category includes measurements of 25 plants. S.E. = Standard Error

	Main Terminal Growth		Lateral Terminal Growth		Lateral Lateral Growth		Control Growth	
	(Feet)	S.E.	(Feet)	S.E.	(Feet)	S.E.	(Feet)	S.E.
Open site	2.61	2.60	2.32	2.50	2.36	2.72	4.09	3.47
Shaded site	2.83	1.70	2.35	0.90	2.08	1.35	2.08	1.92

In white pine grafting, buds from main-terminal or lateral-terminal position should be used if early erect growth is desired. Further investigation will be necessary to determine if age of scion parent tree or open site conditions is most important in reducing differences caused by bud origin.