Black Walnut Trees of Southern Origin Growing Well in Indiana

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Abstract

Black walnut trees from 15 geographic sources were planted in southern Indiana in 1967. After 7 years, trees originating south of the planting site were generally taller and larger in diameter than trees from the north. The tallest trees also tended to have the greatest straight height. Trees from sources south of the planting site should definitely be included in a walnut tree improvement program for southern Indiana.

Introduction

Black walnut (*Juglans nigra* L.) is a valuable timber tree. It is native to most of the eastern United States and is extensively planted. To produce black walnut trees for planting, seed are collected, sown in nurseries, and grown for one year. Indiana alone produces several hundred thousand black walnut seedlings each year.

Just as there are variety differences in agronomic and horticultural crops, there are also differences in walnut trees from various parts of the country. This paper examines the growth of walnut trees in an Indiana test plantation. It was established using seed collected from 15 geographic areas throughout the eastern United States. Information from this and similar tests help to define the "best" areas for black walnut seed collection for southern Indiana thus providing select walnut stock for tree-planting customers.

Methods

In 1967, 1-year-old black walnut seedlings from 15 geographic sources were planted on the Hoosier National Forest in Lawrence County, Indiana (Table 1). The plantation is at 38.7 degrees north and 550 feet elevation. The site is an abandoned field and is level with an alluvial Huntington fine sandy loam soil having good internal drainage. The area was plowed and disced the fall prior to planting. Simazine, atrazine, and dalapon[1] were applied in the spring for 6 years in 6- to 8-foot diameter circles around each tree for weed control.

[1] This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

TABLE 1. *Number, location, and growth data by source.*

Source no.	State	County	North latitude	Height					Straight height	1973 D.b.h.
				1968	1969	1970	1971	1973	1973	
			(degrees)			(feet)				(inches)
1806	IA	Story	42.0	2.43	5.90	8.07	10.55	14.50	13.33	2.27
1607	IL	Ogle	41.9	2.40	5.73	7.97	10.47	14.00	13.58	2.23
1706	IN	Laporte	41.7	1.96	5.22	7.66	10.40	14.20	13.80	2.26
3502	PA	Union	41.0	1.97	6.20	8.03	9.92	13.17	12.33	2.27
		Average	41.6	2.19	5.76	7.93	10.33	13.96	13.26	2.25
1701	IN	Orange	38.6	2.25	5.70	8.60	11.20	13.75	13.25	2.40
2002	KY	Menifee	38.0	2.92	7.04	9.51	12.20	18.40	15.80	2.90
2703	MO	Cedar	37.9	3.22	7.86	10.20	13.30	17.83	16.30	2.95
4102	VA	Craig	37.6	3.16	7.03	9.40	12.08	17.41	14.75	3.13
1601	IL	Union	37.4	2.82	6.68	9.16	12.42	17.30	15.60	3.04
2004	KY	Laurel	37.0	2.77	6.38	8.77	11.58	16.75	15.17	2.67
2001	KY	Logan	36.9	2.42	5.38	6.75	8.80	13.50	12.42	2.15
		Average	37.6	2.79	6.58	8.91	11.65	16.37	14.75	2.74
3803	TN	Union	36.3	2.75	6.62	9.28	12.37	17.42	16.00	3.00
3103	NC	Transylvania	35.3	3.95	8.02	10.45	13.60	19.00	17.00	3.53
3806	TN	Hardin	35.2	4.00	7.88	10.18	12.83	18.92	16.17	3.28
1002	AL	Winston	34.2	2.88	6.80	8.78	11.53	17.33	15.83	2.87
		Average	35.2	3.39	7.33	9.67	12.58	18.16	16.25	3.17
		Overall Average		2.79	6.56	8.85	11.55	16.23	14.75	2.73
		Turkey's critical value						3.28	—	0.75

Trees of each of the 15 sources in the planting were derived from seed collected from an average of six parent trees located within the same stand. The sources came from as far as 250 miles north and south of the planting site.

The planting consists of a randomized complete block design with 6 replicates of 4-tree plots. The trees were planted 12 feet apart. Two rows of trees, an isolation strip, were planted around the study.

At the beginning of the third growing season, European black alder (*Alnus glutinosa* L.) trees, which are nitrogen fixers, were planted between the walnut trees. We expected that the alder trees would act as trainers for the walnut and supply nitrogen to the walnut trees. Each walnut had 4 alder trees surrounding it at a spacing of 8.5 feet.

The planting was judiciously pruned each spring for the first five years to eliminate crook and multiple tops (1, 3). At the beginning of the seventh growing season, lateral branches were pruned to about 5 feet, but never higher than one-half the tree height.

Height growth was measured each year except 1972. We also measured straight height and diameter at 4.5 feet in 1973. Straight height, an indicator of stem straightness, is the distance from the ground line to a point where the main stem of the tree deviates more than one foot from an imaginary line passing through the base of the tree vertical to the ground.

Results

Overall seventh year survival in the plantation was 61 percent. This was unexpectedly low and lower than in other similar plantations (2). Most of the loss occurred during the first two years. Some mortality may be accounted for by brief spring flooding that occurred the first two years. Also, root rot was observed in the seedlings from several geographic sources and undoubtedly caused some mortality.

Survival was not related to the latitude of the seed sources. Similar results were reported by Wright (4). In a region-wide black walnut provenance study, Bey found that survival was unrelated to latitude of the source in six out of the eight test plantations studied (2).

Trees from sources south of the planting site were generally taller and larger in diameter than those of northern origin (Table 1; Figs. 1 and 2). The correlation coefficient between height and latitude of seed source was -0.72. Trees of source 3103 (North Carolina) were tallest, had the largest d.b.h., and best survival. Differences in height and diameter were related to geographic origin. Height differences of 3.3 feet or more and diameter differences of 0.8 inch or more were statistically significant at the .05 level.

Trees originating from south of the planting site have gradually increased their lead (Fig. 3). At this time, it appears that the trees from

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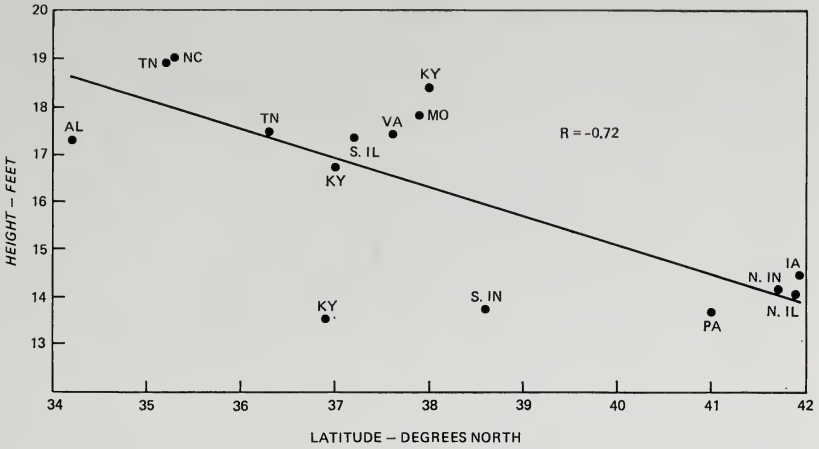

FIGURE 1. *Relationship between latitude and 1973 height of trees from various sources.*

the southern origins are winterhardy and that they will be the superior sources for southern Indiana in the future.

The local southern Indiana source (1701) had considerable root rot at planting time, possibly accounting for its low survival and poor

FIGURE 2. *Trees of Tennessee origin (on left) were taller than those from Iowa (on right) at age 7.*

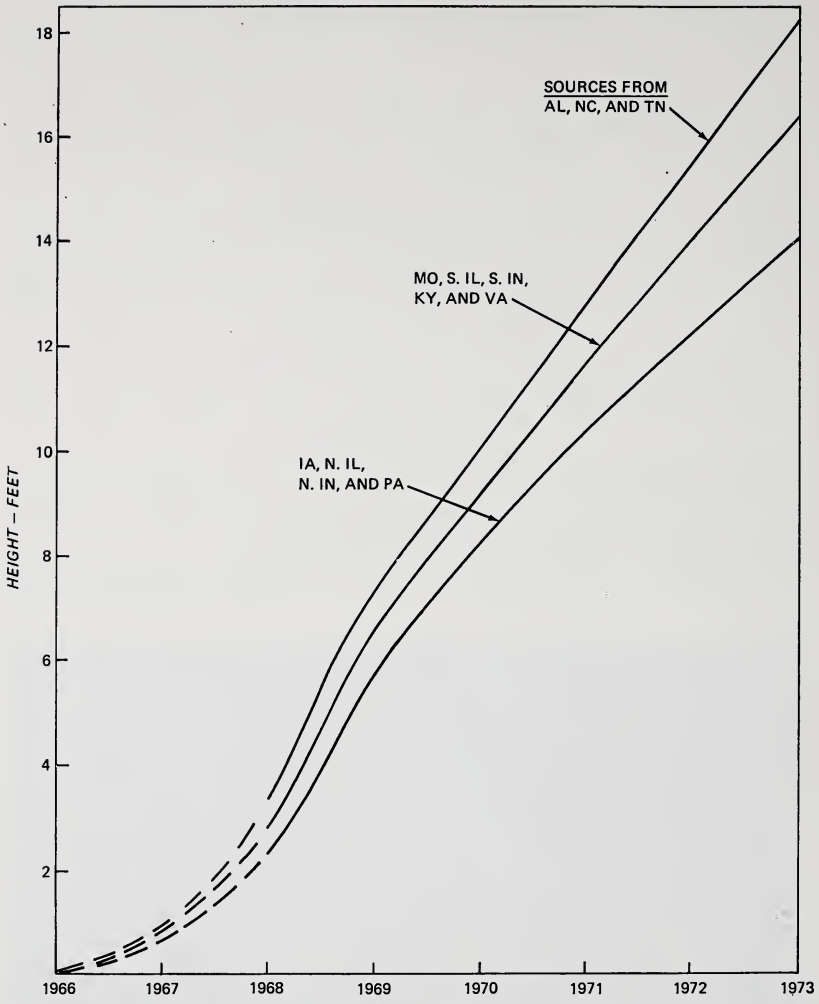

FIGURE 3. *Trend of total height of trees from various geographic origins for six years since planting.*

growth. There is no apparent explanation for the poor growth of trees from Kentucky source (2001). Root rot was not a problem and survival was about average for the plantation. The danger of drawing conclusions based on too few trees is illustrated by this example.

Tallest trees also tended to have the greatest straight height. A correlation coefficient of 0.96 was significant. Similar to the pattern for total height, trees of southern origin tended to have greater straight height. The correlation coefficient between straight height and latitude of source was 0.69. Although these relationships were strong, differences in straight height among sources were not statistically significantly different at the .05 level.

As the tree crowns in the plantation begin to close, taller trees act as trainers for each other and particularly for the shorter trees. This may minimize seed source differences for straight height and is an inherent problem in many field experiments. Only with very wide spacing would it be possible to keep the effects of seed source and mutual training separated.

Four years after the alder trees were planted, 20 percent of them were taller than the walnut trees. At that time, tops were cut out of those alder trees interfering with the growth of the walnut. The alder has aided stand closure and apparently has assisted in "training" the walnuts to grow straight. Also, we assume they are supplying additional nitrogen to the soil. When the crowns of the alder and walnut begin overlapping, the alder trees will be removed.

Discussion and Conclusions

The trees in this study have grown well, and we believe that they will eventually produce high quality logs. Trees from stands in North Carolina, Tennessee, and Kentucky were generally larger than those of local and northern origin. Trees from these geographic areas should be included in walnut tree improvement programs for southern Indiana.

Tree height is probably the best trait for evaluating the value of trees at a young age. Trees severely damaged by winter cold and/or late spring frosts are likely to have multiple tops and be shorter. If they are damaged by the cold, overcome it, and are still the tallest, we should probably not be greatly concerned with the damage.

Although not specifically tested in this study, we believe that weed control, interplanting of European alder, and corrective pruning have been helpful in promoting rapid growth and good form. During the early years we were not optimistic that this would be a successful plantation. Floods, wind, insects, and deer all took their toll. Despite these adversities, the plantation now shows excellent potential. For every force in nature that tends to destroy there seems to be an equally strong force to restore. With careful site selection, proper culture, and selection of the best geographic seed sources, maximum growth and quality in black walnut plantations can be obtained.

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