Root Fibrosity Proves Insignificant in Survival, Growth of Black Walnut Seedlings

In test plantings with black walnut in Illinois and Indiana, fibrous rooted seedlings did not survive better or grow faster than single taprooted seedlings. Stem diameter appears a better indicator of early height growth than root fibrosity.

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Black walnut seedlings normally develop a single, carrotshaped taproot, but root fibrosity can be greatly enhanced by modifying soil texture and by certain cultural practices. [1] Foresters have speculated that a more fibrous rooted seedling would survive better and grow faster than the normal taprooted seedling. But field plantings in Illinois and Indiana have *not* shown the expected advantages to survival and growth of fibrous multiple rooted seedlings. Rather, stem diameter of the seedlings appears to be a better indicator of early height growth than does fibrous root development.

[1]Clark, F. Bryan. 1968. Factors affecting the production of fibrous roots on black walnut seedlings. Ph.D. Thesis on file in the Botany Department, Southern Illinois University, Carbondale, Ill.

Study Methods

Illinois

Black walnut seedlings for the Illinois planting were grown at the Union Tree Nursery. Seed was collected locally, stratified over-winter, and germinated in flats in May. When the root radicles of the germinated seed were about 1 inch long, the seed was divided into three equal lots. The root radicles in one lot were clipped before planting to force the development of secondary roots. Seed from a second lot was planted intact; then, when the seedlings were 6 to 8 inches tall, their roots were undercut with a spade to encourage development of secondary roots. Roots in the third seedlot were *not* pruned.

After 1 year in the seedbed, thewere lifted and rootpruned to 10 inches. These 1-0 seedlings were planted in March 1967 in auger-bored holes in a uniform bottomland field on the Kaskaskia Experimental Forest in southern Illinois. Each of the three types of seedlings was tested in 10 randomly selected five-tree rows. Weeds in the plantation were controlled by chemical and mechanical methods. Growing condition] were nearly ideal the first year and remained good during the 4-year study period. After the first growing season, two trees were selected at random from each of the three treatments and were carefully excavated to examine the root system.

Indiana

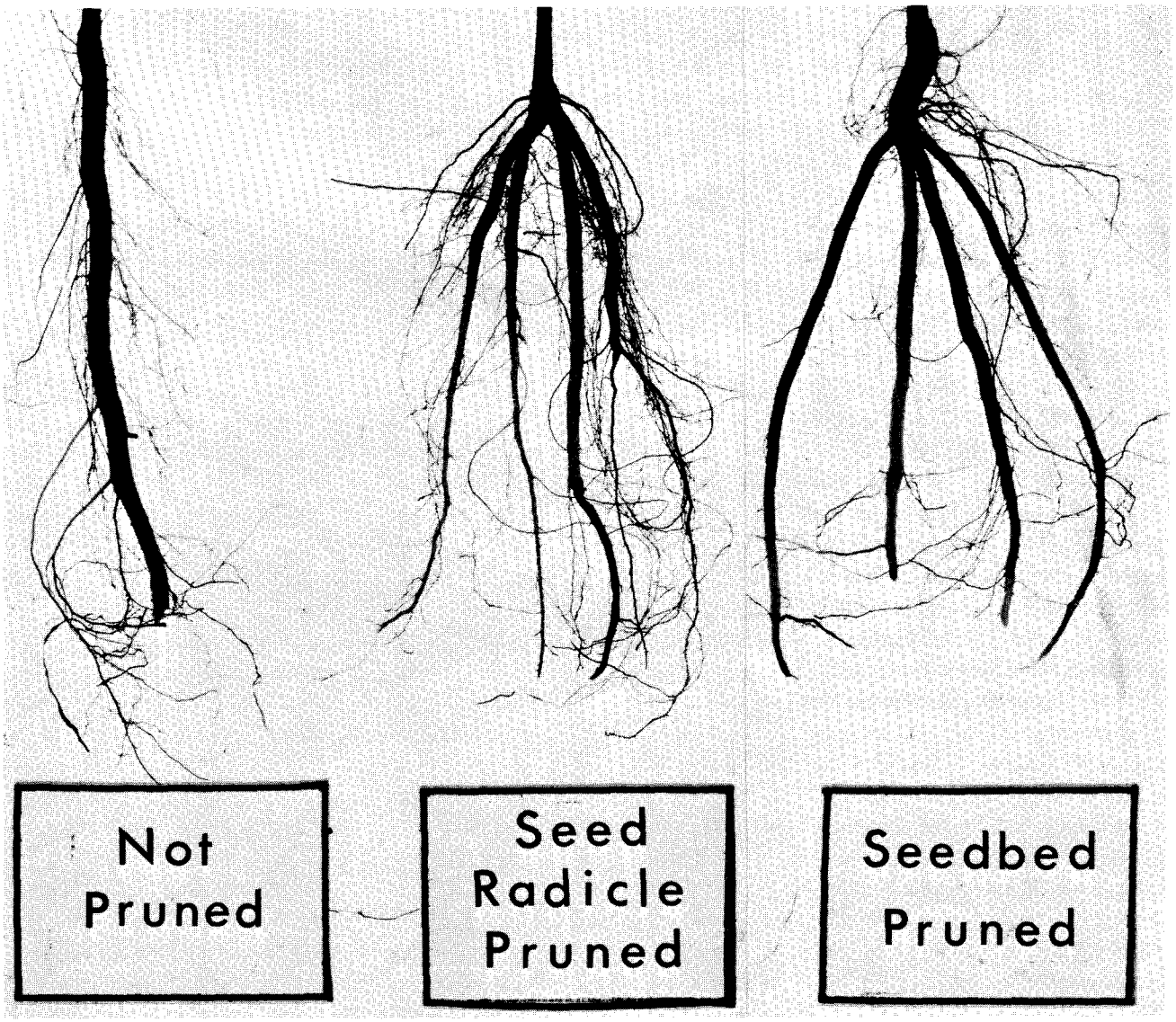
Seedlings for the Indiana planting were grown at the George 0. White State Nursery in Missouri and the Vallonia State Nursery in

Indiana. Seed for both nurseries was collected in the fall of 1965 from a single stand of trees in southern Indiana and was sown soon after collection. The seedlings were lifted the next fall and placed in cold storage. Seedlings grown at the Vallonia Nursery had developed a much more fibrous root system than those grown at the George O. White Nursery. A greenhouse pot study using soil from the two nurseries showed that most of the differences in fibrous rooting were caused by soil differences at the two nurseries.

One hundred seedlings from each nursery were graded into two stem diameter classes: 50 in the 9/32-inch and 50 in the 14/32inch class; both measured 1 inch above the root collar. The seedlings were root pruned to 10 inches and planted in auger-bored holes in April 1967 in a fertile, uniform, well-drained field near Martinsville, Ind.[2] Each of the four combinations of root fibrosity and seedling caliper classes was tested in 10 randomly selected five-tree rows. Competing weeds

[2]Cooperation of the Pierson-Hollowell Veneer Company of Indianapolis, Ind., is acknowledged.

Figure 1.—Seedlings pruned in the seedbed in June and those with radicle clipped before planting developed branched roots while unpruned seedlings developed a single, unbranched taproot.



and grasses were controlled by chemical and mechanical methods.

Rainfall in the area was below normal during July and August the first year. Growing conditions were only fair the first year, but were good the next 2 years.

Results

Root pruning resulted in striking differences among the root systems of the 1-0 seedlings in the Illinois study (fig. 1). Radicle pruned and seedbed pruned seedlings developed multiple (average 2.8) taproots, while unpruned seedlings had the normal, unbranched, carrot-shaped taproot. Both pruning methods produced seedlings with similar root systems.

After growing in the field for a year, the radicle and seedbed pruned seedlings had developed longer, more fibrous root systems than the unpruned seedlings (fig. 2). However, the fibrous root system of the pruned seedlings was twisted, even though the seedlings had been planted by experienced planters.

After 4 years, there were *no* significant differences among the three pruning treatments in survival, height, or diameter (table 1). Only six of the 150 planted trees died. Starting the second year, the surviving trees in all treatments grew 2 to 3 feet in height annually. The radicle pruned seedlings grew only 0.2 inches more in d.b.h. than the unpruned seedlings, but this difference may increase with time.

Inthe Indiana planting also, the fibrous rooted seedlings did not survive any better or grow any faster than the nonfibrous rooted seedlings (table 2). However, the larger diameter seedlings were about 0.6 foot taller than the smaller diameter seedlings (statistically significant) after the 3-year period. Seedling diameter had no effect on survival or diameter growth, but the larger

TABLE 1.—Fourth year survival, height, and diameter of trees by pruning treatments, Illinois planting

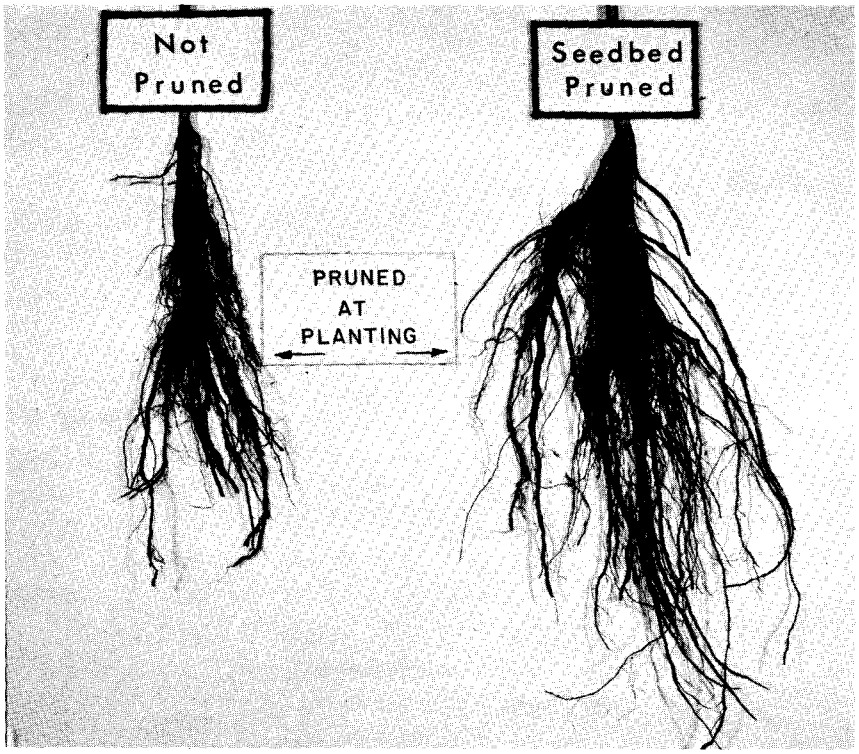
Pruning treatment	Survival	Height	Diameter
	Percent	*Feet*	*Inches*
Unpruned.....	94	10.8	1.5
Seedbed pruned.....	94	10.8	1.6
Radicle pruned.....	100	11.3	1.7

TABLE 2.—Third year survival, height, and diameter of seedlings by root type and size class, Indiana planting

Root type	Survival	Height	Diameter[1]
	Percent	*Feet*	*Inches*
Nonfibrous			
9/32 inch.....	94	5.5	1.2
14/32 inch.....	96	5.9	1.2
Fibrous			
9/32 inch.....	98	5.2	1.1
14/32 inch.....	96	6.0	1.3

[1]Diameter measured 6 inches above ground.

Figure 2.—Trees excavated one growing season after outplanting show that seedlings pruned in the seedbed developed larger and more fibrous root systems than those not pruned. All trees were root pruned to 10 inches at outplanting.



diameter seedlings did maintain their original diameter advantage. Only four of the 200 trees planted in this study died during the 3-year period.

Discussion and Conclusions

Root fibrosity of black walnut seedlings was increased by pruning radicles of germinating nuts, by pruning roots of seedlings in seedbeds, and by growing seedlings in sandy soils. However, the additional fibrous roots did not significantly benefit subsequent survival and growth. Stem diameter was a better indicator of early height growth than root fibrosity. The number of fibrous roots that develop on nursery grown seedlings will probably be adequate if the seedlings attain a suitable size for planting.

During planting, the fibrous roots were easily twisted, which could cause poor growth at a later age. Greater care during planting may be required for more fibrous rooted seedlings. New root formation occurs primarily on fibrous roots. Therefore, the loss of fibrous roots, through poor lifting or handling, may cause poor survival and growth, especially under drought conditions. Thus, the fibrous roots present on black walnut seedlings should be preserved, but it does *not* appear necessary or desirable to increase root fibrosity of these seedlings by cultural methods.

NEWS & REVIEWS...

Research Underway On Loblolly Seed Loss ...

At the Forestry Sciences Laboratory in Athens, Ga. scientists are finding ways to reduce seed losses in seed orchards. The seed-production potential in seed orchards of loblolly pine is reduced one-third by cone and seed insects. These insects greatly increase the costs of producing genetically superior trees. Without adequate controls, the size and cost of secondgeneration orchards will have to be increased by 50 percent to supply the needed quantity of sound seed.

About 8 percent of the yield of loblolly pine per acre is lost because of attack by rust diseases. Researchers at Athens hope to reduce this loss to 3 percent. The most promising research strategy is to breed and culture loblolly pines that have inherent resistance to rust.

In Search of The City Tree

City trees should grow to desired heights; tolerate air pollution, salt, bumps from cars and drought; resist diseases, insects; and not clog sewers or crack pavement. They should provide shade and be beautiful. To date, the sycamore has come closest to meeting many of these standards. Frank S. Santamour Jr., a research geneticist at the National Arboretum believes a super city tree is possible and since mid-1967 he has been working to develop better varieties of urban trees. At present, he is cross-breeding 20 different kinds of trees in search of one that can best withstand the urban life of the 20th Century:

Alternative to Chemicals

Genetically resistant seedlings may provide a useful alternative to chemical repellents for reducing damage by deer and hare in planted Douglas-fir forests. Forest Service research detected such resistance in ponderosa pine as far back as 1927 and confirmed it in 1962. Recent work in the Pacific Northwest proves both the presence and the heritability of resistance traits in Douglas-fir. Unlike artificial repellents, resistant trees could provide year-round protection for as long as needed. However, it may take a decade to intensify resistance or to breed seedling stock in the numbers required. Physiological research is underway to determine chemical factors underlying resistance.

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