

Black Walnut Seedling Seed Orchard Development --  
A Case History

Calvin F. Bey, Allan S. Mickelson, and Melvin Gerardo\*

ABSTRACT

The major phases essential for developing a black walnut seedling seed orchard include: (1) defining the planting areas and seed collection areas, (2) collecting seed for the seed orchard trees, (3) selecting the orchard site, (4) establishing the orchard, (5) care and maintenance of the orchard, (6) selecting superior phenotypes and thinning the orchard, and (7) planning for the next-generation orchard.

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Black walnut seed orchards can provide nurserymen with easily accessible, genetically improved seed of known origin. Not only nurserymen, but landowners as well will benefit when orchards are established and seed production begins. The seedling seed orchard approach described in this paper can be a useful guide for establishing black walnut seed orchards.

We believe that the seedling seed orchard approach is appropriate for black walnut. <sup>1</sup>/Seedling walnut trees bear early -- as early as age 4, Seedling seed orchards can be used for progeny tests since the intensive cultural practices that are used in seed orchards are similar to those recommended for standard walnut plantation management. Seedling orchards are also easier and cheaper to establish than grafted orchards.

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<sup>1</sup>/Funk, David T. 1966, Seed Orchards., In Black Walnut Culture , p. 62-65. USDA Forest Service, N. Central Forest Experiment Station, St. Paul, Minn.

\*The authors are, respectively, Plant Geneticist, North Central Forest Experiment Station, Carbondale, Ill. (office maintained in cooperation with Southern Illinois University); Staff Forester, Reforestation, Division of Forestry, Illinois Department of Conservation, Springfield, Illinois; and Nurseryman, Division of Forestry, Illinois Department of Conservation, Jonesboro, Illinois.

## DEFINING THE PLANTING AREA AND SEED COLLECTION AREA

The State of Illinois, about 400 miles from north to south, has been divided into two major seed collection (climatic) zones. <sup>2/</sup> We refer to the southern zone as the planting area for this orchard. The seed orchard that we have established will produce seed for the southern half of Illinois, but as new information becomes available, we may want to use the seed in other areas.

The seed collection area for the orchard, that will produce seed for planting in the southern half of Illinois, included an area from southern Tennessee (35° N) to south-central Illinois (39° N). The distance from the southernmost source of seed to the northernmost area of the planting zone (mid- Illinois) is about 400 miles. The average distance of seed movement is about 125 miles northward (Fig. 1). Walnut seed source studies have shown that trees grown from seed collected south of the planting site are faster growing than trees from local and northern areas, and are cold hardy as well.

## COLLECTING THE SEED

To get a variety of black walnut genotypes in the designated seed collection area, we collected seed from 100 parent trees. Cooperators were asked to locate straight-stemmed and vigorous native trees, but many of the selected trees were in dense stands, did not produce sufficient seed, and so were not used. The trees that were used are probably best classified as average for straightness and vigor. Most of the trees can be called "run-of-the-road" selections. Obtaining trees from representative locations was considered more important than selection based on any minimum standards for growth and form. When we had a choice, we collected from the largest and straightest trees. It is difficult to select walnut plus-trees since many candidates occur as single trees, and direct comparisons cannot be made. Even where other walnuts are present, age and site differences make plus-tree selection difficult and questionable. Because of these difficulties, we feel that a less rigorous selection approach is reasonable and acceptable.

Each seed lot was numbered and the location of the parent tree recorded. We do not plan to collect seed from the same trees again, so only general locations were recorded; for example, "2 miles west of Brownstown". No other data for the parent trees were collected

2/Limstrom, G. A. 1965. Interim Forest Tree Improvement Guides for the Central States—USDA Forest Service, Research Paper CS-12, 62 pp., illus Central States Forest Experiment Station.

3/Bey, Calvin F. Toliver, John R., and Roth, Paul L. 1971. Early Growth of Black Walnut Trees from Twenty Seed Sources. USDA Forest Service, Research Note NC-105, 4 pp. North Central. Forest Experiment Station, St. Paul, Minn.

We collected 200 seed from each of 50 trees in Illinois and 50 trees in the other four states. The seed was cleaned, weighed, and stored in plastic bags at 34 F. until spring.

### SELECTING THE ORCHARD SITES

Although we generally recommend planting black walnut on good, bottomland sites, we know that it will also be planted on upland sites with moderate productivity. Since this orchard is also serving as a progeny test, we established it on sites that are typical of those where walnut will be planted. We selected two sites -- a deep, well-drained bottomland soil in Union County (Illinois Department of Conservation lands), and a moderately productive, upland site in Jackson County (Southern Illinois University Farms lands). The bottomland soil was a sandy loam; the upland soil was a silty-clay loam. The upland site, typical of fruit orchard sites in the area, is more likely to escape late spring frosts than is the bottomland site. Each orchard is about 3 acres in size.

### ESTABLISHING THE ORCHARD

Methods of establishment were similar on both sites. The bottomland field was covered with heavy, tall fescue sod. In early spring, a small area, 1 foot in diameter, was scalped where each seed was to be planted. When the fescue began to grow in the spring, we sprayed 5-foot strips (rows) with chemicals for weed control.<sup>4/</sup> The upland field had been in corn the previous year and needed only the pre-emergent chemical treatment.

In mid-April, 1970, the bags of seed were taken from the cooler and placed in a warm room. In 1 to 2 weeks, when the seed began to germinate, they were taken to the field and planted. We made a hole 2 inches deep, carefully placed the germinating seed in the hole (with the radicle pointing downward), and replaced the plug of soil (Fig. 2).

Each field was laid out in 5 blocks . In each block we planted 5 seeds from each parent tree. The seeds were planted 4 feet apart in rows spaced 10 feet apart. Walnut trees from local sources were planted at the end of each plot and around the preiphery of the field to eliminate edge effect.

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.

Caution: Pesticides can be injurious to humans , domestic animals desirable plants, and fish or other wildlife--if they are not handles or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers .

## CARE AND MAINTENANCE OF THE ORCHARD

The seedlings came up in 1 to 2 weeks. There was no squirrel pilferage in the bottomland planting, and only a small amount at the upland site. In areas where rodent pilferage is expected to be a problem. 1 year old seedlings should be substituted for germinating seed. Except for hand spraying to kill some multiflora rose, no additional chemical weed control was used during the first growing season. The grass area between the rows was mowed several times during the summer. In the fall, deer damaged the tops of a few trees by chewing and rubbing with their antlers .

The average height and diameter at one inch above ground after one growing season was 1.5 feet and 7/16 inch, respectively. The tallest tree was 4.2 feet; many were 2 to 3 feet tall. Many trees had diameters from 1/2 to 1 inch (Fig. 3).

In the spring of 1971, we sprayed a 7-foot strip using chemicals for weed control. Trees that had broken and deformed terminals (due to deer, birds, and wind) were correctively pruned during 1971. A record is being kept of all trees that are pruned. After two growing seasons, many trees are over 1 inch in diameter at 1 inch above the ground, and over 6 feet tall. The tallest tree is over 9 feet,

## SELECTING SUPERIOR PHENOTYPES AND THINNING THE ORCHARD

We expect rapid growth on these trees in the next few years, which means that an early roguing will be necessary. At age 4, we plan to cut about half of the trees in each plot (within family selection). Selection will be based on growth, straightness, and date of leaf flush. At age 10 and 15, we plan to thin another 25 and 15 percent of the original trees; we will save only 10 percent of the trees. The number of complete families and the number of trees within families that are removed will be based on the average performance of the family and the variation present at the time of the thinning, as well as information from additional progeny tests. The after-thinning spacing at ages 4, 10, and 15 will average 9 x 9, 13 x 13, and 20 x 20 feet. Assuming one-half inch of diameter grove per year, these spacings will permit maximum crown development.

<sup>5/</sup> Krajicek, John E. 1968, Maximum Use of Minimum Acres. Southern Forest Tree Improvement Conference Proceedings 9: 35-37.

## PLANNING FOR THE NEXT-GENERATION ORCHARD

When seed production begins, we will begin progeny-testing of the selected orchard trees. The progeny tests for the selected orchard trees can become the second-generation seed orchard. Information from these second-generation progeny tests will be used to help select the superior trees in the original orchard. This continuous process of genetic improvement, called recurrent selection, has been used in agronomic crops and should also be successful for black walnut (Fig. 4).

We believe that the procedures described in this paper can be effective in establishing black walnut seed orchards. The size of the orchard, number of parent trees selected, and the amount of roguing and record keeping will vary with the needs and objectives of each project. We have followed regular plantation establishment practices and have had relatively few problems. Growth of the trees during the first two years has been excellent and we think that the genetic gains resulting from this project will be worthwhile.





Figure 1 -- Seed Collection Area (Shaded) for Southern Illinois Planting Zone .



Figure 2 -- Bey, Mickelson and Gerardo  
"Black walnut seedling seed orchard ....





Figure 3 -- Bey, Mickelson and Gerardo  
"Black walnut seedling seed orchard .....



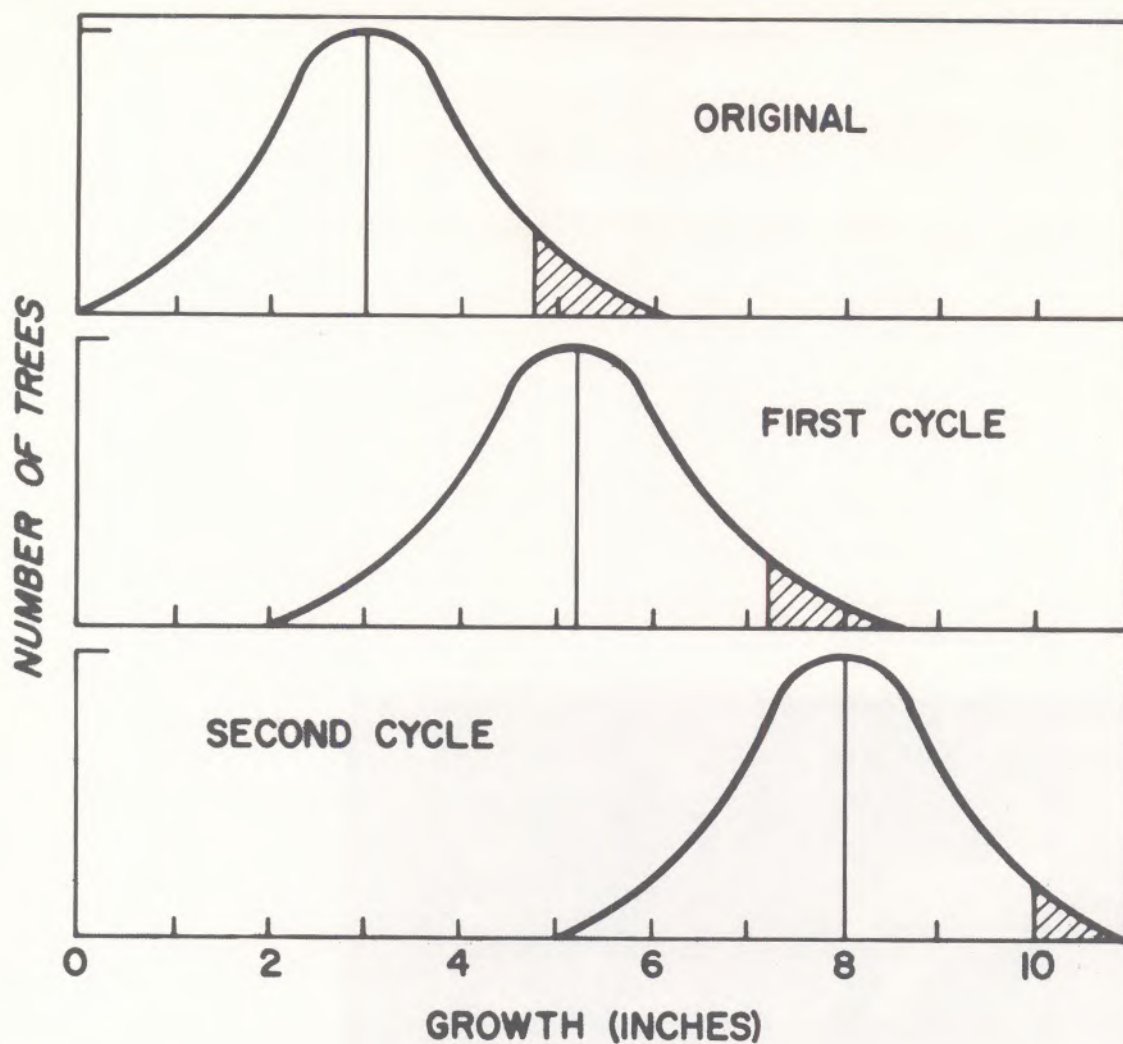


Figure 4 -- Frequency Distribution for Growth after Two Generations of Recurrent Selection. The Mean is Indicated by a Solid Vertical Line. The Hatched Area Indicates the Selected Trees .