Walnut Site Selection and Soil Management

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Attempts to establish hardwood plantations during the late 1930's and early 1940's in the Central States region were generally unsuccessful. As a result, many landowners have shunned hardwood planting because of the high probability of failure. Current research on black walnut is revealing the major reasons for these failures, and refuting this. generalization about the difficulty of hardwood planting. The primary causes of these failures were off-site planting and the lack of early care of the plantations. In this paper we will consider site evaluation for walnut and some of the soils aspects of walnut plantation establishment and management.

Site selection should be the walnut grower's primary concern. Because of the large investment necessary, selecting a site must not be a cursory search for any old field as was the case in many past instances. The landowner should determine if the soil and site will sustain rapid growth of walnut from planting to maturity. Preliminary research results and field experience in southern Illinois, Indiana, and Missouri are revealing some of the soil characteristics that most affect walnut growth.

Many of the soils on the flood plain along small streams in this area are underlain by thick deposits of gravel. The thickness of the silt loam soil material over the gravel ranges from about 6 inches to more than 4 feet. Although there may be water in the gravel layer, walnut plantations on such sites depend upon moisture in the silty soil above the gravel. This soil layer must be at least 2-1/2 feet thick to supply adequate moisture for desirable walnut growth. Although sites with a thinner soil layer will support rapid growth for 10 to 15 years, sometime after this initial growth period the rate of growth decreases abruptly.

This information about the relation between site conditions and height growth will result in new site-index curves. Preliminary data from walnut studies in southern Illinois indicate that initial growth is rapid and then sometime after 10 to 15 years the rate of height growth gradually decreases because of soil, site, stand, or species characteristics. But on poor sites, such as soils with the gravel layer at the depth of less than about 2-1/2 feet, growth differs significantly from this

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traditional pattern. On these soils the initial growth period is similar to the better sites for about 10 years, but this is followed by a period in which there is an abrupt decrease in height growth rate. When these walnut plantations are invaded by more adapted volunteer species, the walnut gradually succumbs to competition and dies. In some cases, weeding and thinning might effectively bring the stand to maturity, but the risk of failure is high.

Somewhat the same growth relationship occurs on soils classified as imperfectly drained because of slow internal drainage or extended periods of saturation by a high water table. In these soils the effective rooting depth is restricted to the aerated soil layers above the zone of water saturation. When these soils drain and dry out there is not enough moisture in the thin rooting zone to support rapid growth. Data and observations indicate that the effective rooting zone must be more than 2-1/2 feet thick above the mottled zone (with soil color characteristics indicating extended water saturation) for desirable walnut growth. For example, height growth was about 50 percent greater in a plot with no mottling above 48 inches than in a plot with the soil mottled at 11 inches (Table . And more importantly, the average tree diameter (at 25 years) of this latter plot was less than 60 percent of that of trees on the well-drained soil. If these rates of diameter growth were maintained, a 16-inch veneer log would be produced in about 50 years on the well-drained soil, but it would take more than 80 years on the poorly drained soil. Also, the stems of the trees grown on the poorly drained soils would probably be of lower quality, and hence lower value, than those produced on the well-drained soil.

Table 1. -- Relationship of depth-to-mottling to black walnut height and diameter growth.

Plot	Depth to mottling	Growth at 25 years	
		Height	D.b.h. (inside bark)
	Inches	Feet	Inches
1	48 +	62	8.3
2	32	56	6.4
3	11	41	4.8

These are but two soil characteristics readily associated with the rate of growth. There are numerous relations not as easily explained because of the complex interaction of soil, site, stand, and species. In general, the more desirable sites for walnut. are flood plains, low stream terraces, and the lower portion of north-facing slopes and coves. The soils should be medium-textured (silt loam to loam) , deep, and well drained. Closely associated with these site and soil characteristics, is a fertility level adequate for walnut. Good walnut may occur on other sites, but the landowner should examine the soil very closely to determine if the area will support the plantation to maturity.

The walnut grower must consider several aspects of soil management during the establishment of a walnut plantation. Pre--emergent herbicides are commonly used to control weeds in plantations. Soil characteristics influence the application rate of such herbicides. Fine-textured or alkaline soils or soils having much organic matter, generally require more herbicide per acre than coarse--textured, acidic, or mineral soils. Hence, the rate of application must be adjusted to allow for these differences.

Weed control exposes the soil surface to erosion. Therefore, we recommend strip weed control on the contour to reduce the exposed surface area, as well as for the sake of herbicide and machine-application economy. In extreme erosion-hazard situations spot weed control around each seedling could be used. Although spot control uses the least herbicide, expensive ha nd labor must be used to apply the herbicide. Currently, research is underway to determine the most desirable width of the strip and diameter of the spot around the seedling.

In established plantations, plans for thinning, weeding, fertilization, and possibly irrigation will partly be determined by the soil characteristics of the area. These cultural practices are applied primarily to obtain rapid diameter growth. The intensity and timing of these practices will be related to the capacity of the soil to provide the optimum amount of moisture and nutrients to sustain rapid annual diameter growth. If annual rate of diameter growth declines, a change in the characteristics of the stand (thinning and weeding) or of the soil (irrigation and fertilization) is necessary to provide the crop trees with an adequate supply of moisture and nutrients. Both kinds of treatment in a sense accomplish the same end because the existing moisture and nutrient supply goes to support growth on. the selected crop trees.

The culture of black walnut will undoubtedly become the most: intensive forestry practiced in this country. Large investments will be made for land, site preparation, planting, and cultural practices. The magnitude of this investment and the kind of intensive culture will depend upon the soil characteristics, which determine the inherent productivity of the site and the response of soils to these cultural practices. For the landowner to obtain maximum profit, he must know where to plant and then when and how to apply the recommended practices.