Importance of Seedling Size for Survival and Growth

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The advantages of planting large seedlings have been shown for several species: shortleaf pine (Chapman 1948, and Clark and Pharos 1961); yellow-poplar (Limstrom, Finn, and Deitschman 1955, Rodenbach and Olson 1960, and Funk 1964); sycamore (Ike 1962); and sweetgum (Johnson and McElwee 1967) . Our research with black walnut seedlings shows that both survival and growth are improved by planting large seedlings.

Many black walnut plantations are being established on high-priced. agricultural land. The sites are plowed, disced, and treated with herbicide, and seedlings are planted at wide spacing. These high costs of plantation establishment justify the planter's demands for high-quality planting stock.

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Study Methods:

Since 1960 graded 1-0 black walnut seedlings have been planted on cleared forest sites, coal strip-mined land in southern Indiana, and on a cultivated old field in southern Illinois. The seedlings were grown at State nurseries in Indiana and graded on the basis of stem diameter measured 1 inch above the root collar. Survival and early growth of seedlings of five size classes (4/32-, 6/32-, 8/32-, 10/32-, and 12/32-inch) (Fig. 1) were compared in experimental plantings. 1/ Damaged, diseased, and unbalanced seedlings (usually tall or short for the diameter class) were discarded. Seedling roots were pruned to a maximum length of 10 inches.

Seedlings planted on the cleared forest sites and strip-mined sites were not released while the study was in progress. The old field plantation was cultivated when needed to determine if small seedlings are acceptable planting stock under the most favorable conditions.

Results and Discussion:

Large seedlings survived better, and were taller, after two growing seasons than small ones on. all sites studied (Table 1).

Second-year differences in survival among seedling size classes were most evident on the ridge and upper slopes of the strip-mined sites. Results from these sites showed that walnut plantings should be confined 'to the lower half of the banks. Survival on -the ridges and upper slopes was poor for all size classes, ranging from 28 percent 'to 61 percent for the smallest to the largest seedlings. On the more favorable lower slopes, only 46 percent of the 6/32-inch seedlings survived. Rut survival. of the larger size classes ranged from 90 percent for the 8/32 seedlings to 100 percent for the 12/32-inch ones.

Black walnut seedlings suffer transplant shock and few grow much the first, and often the second growing season, even under the most favorable conditions. However, differences in growth rate among seedling size classes were well defined after the third growing season. Four-year results of three of the plantings show that the superiority of seedlings 8/32-inch and larger becomes more accentuated each year after planting, both in terms of better survival and faster growth (Table 2).

1/ Latin squares on cleared forest sites; randomized blocks on strip mine and cultivated old field sites.

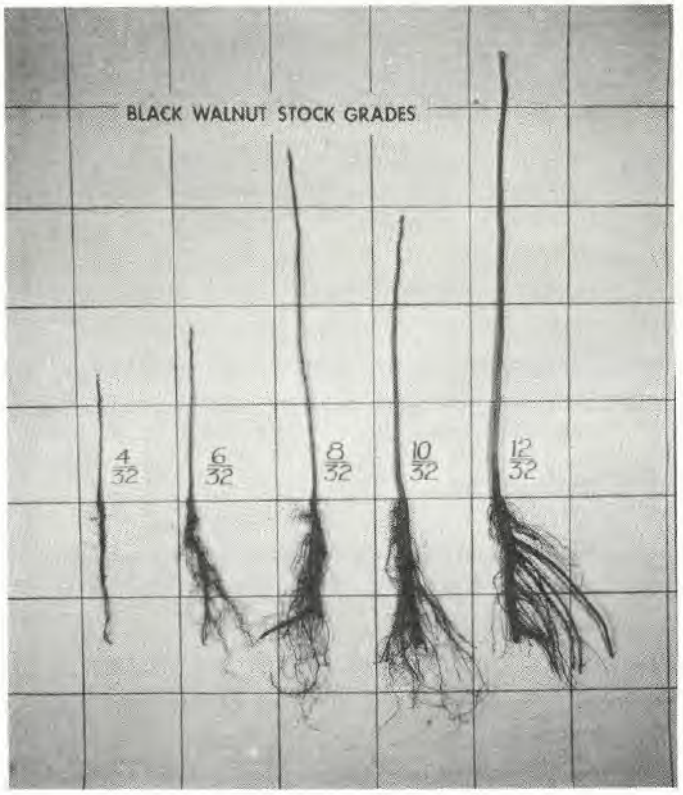

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Figure 1. -- Typical 1-0 black walnut seedlings.

Table 1. --Second-year survival and height by site and seedling size.

Location and planting dates	Survival, Seedling diameter (inches)					Mean Height, Seedling diameter (in.)				
	4/32	6/32	8/32	10/32	12/32	4/32	6/32	8/32	10/32	12/32
	Percent					Feet				
CLEARED FOREST SITES										
Paoli (1960)	75	84	86	90	93	1.3	1.2	1.8	1.8	2.3
Bedford (1961)	76	89	96	99	95	.9	1.0	1.4	1.6	1.8
Mitchell (1962)	71	82	90	90	92	1.2	1.3	1.8	1.7	1.9
Darlington (1962)	82	94	89	81	85	1.0	1.1	1.6	1.7	1.8
COAL STRIP-MINED STIES										
Lynnville (1961)	(1/)	56	70	87	93	-	.7	1.3	1.3	1.8
Lynnville (1963)	36	53	51	51	73	.6	.9	1.0	1.0	1.3
CULTIVATED OLD FIELDS										
Kaskaskia (1966)	57	84	89	98	98	2.4	2.7	3.3	3.5	3.6

1/ 4/32-inch stock not available.

Table 2. -- Four-year survival and height growth by seedling size.

Location and planting date	Seedling Diameter (inches)				
	4/32	6/32	8/32	10/32	12/32
SURVIVAL					
	Percent				
Paoli (1960)	63	83	83	79	93
Darlington (1962)	64	82	68	78	81
Lynnville (1961)	(1/)	44	61	73	79
HEIGHT GROWTH					
	Feet				
Paoli (1960)	2.1	1.9	3.0	3.4	4.0
Darlington (1962)	1.2	1.4	3.0	2.7	3.0
Lynnville (1961)	(1/)	.2	.5	.6	.5

1/ 4/32-inch stock not available.

The need for more large black walnut seedlings may increase. At present, most walnut seedlings are being planted on good sites. Many landowners also believe that poor walnut trees will yield more income from a poor site than any other species. So there has been some demand to find out if black walnut seedlings will survive and grow on poorer sites such as some of the drier upland sites. The work on strip-mine banks showed that as site quality decreases the need for large walnut seedlings increases. If walnut is planted on upland sites, there will • be an even greater need for large seedlings.

Landowners will continue to plant nursery-grown seedlings because direct seeding has not been successful. Good survival of the outplanted seedlings is essential and fast growth is desirable. Because large seedlings survive better and grow faster than small ones, nurserymen should strive to furnish large seedlings.

Armed with the latest technical information, including seed handling and cultural measures, nurserymen can consistently produce a high proportion of large seedlings, 8/32-inch diameter and larger. Undersize seedlings should be discarded. If necessary, the price of the larger seedlings could be increased to compensate for discarding the small ones. Most planters will prefer the larger seedlings even at higher prices.

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