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PLANTING METHODS AND TREATMENTS FOR BLACK WALNUT SEEDLINGS

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Survival of planted black walnut seedlings usually has been good but early growth has been poor, especially during the planting year. Black walnut seedlings planted on good sites and given adequate weed control normally grow well during the second and succeeding years, but very few grow the first year; in fact, many die back. In an effort to get walnut seedlings to grow faster, earlier, we planted different size, 1- and 2-year-old, pruned and unpruned seedlings by various methods on forest and field sites. Results from four experimental plantings show that planting method has little effect on survival or early growth of black walnut seedlings.

The study was begun in 1964 with a planting on a cleared-forest site in southern Indiana. Supplemental plantings were established in succeeding years on open-field sites in southern Illinois.

CLEARED-FOREST SITE

Methods

The cleared-forest planting site was prepared by clearcutting an opening on the lower half of a forested, north-facing slope in southern Indiana. Walnut seedlings were planted no closer than 75 ft to the trees on the perimeter of the opening. Except for some large cull logs left by the loggers, stems and tops were removed from the planting area. Stumps smaller than 12 in. in diameter were treated with an herbicide to control sprouting. With the exception of a planting-year simazine treatment on some plots, competition was not controlled.

Four planting spot treatments were randomly assigned in each of four contiguous blocks on the cleared-forest area:

1. Check--no treatment.
2. Fertilizer--3 oz of 8-32-8 per tree. One oz was applied in the planting hole, and 2 oz were broadcast in a cultivated, 3-ft-diameter circular area around each tree a month later.
3. Simazine--4 lb of 80 percent wettable powder per acre applied in a 4-ft cultivated strip with the seedlings planted in the center of the strip.
4. Fertilizer plus simazine--applied as indicated for treatments 2 and 3.

Ten combinations of planting methods, seedling age and size, and seedling pruning treatments were assigned at random to ten 10-tree rows within each of the 4 planting spot treatments in each of the 4 blocks:

Planting methods

10/32 In. Seedling Diameter[1/]
- Mattock slit: 8-in. root planted to root collar.
- Hole:[2/] 12-in. root planted to root collar.
- Hole: 12-in. root, deep planted 4 in. above root collar.
- Hole: 8-in. root planted to root collar.
- Hole: 8-in. root, deep planted 4 in. above root collar.
- Hole: 8-in. root, 1-in. top, planted to root collar.

16-18/32 In. Seedling Diameter
- Hole: 12-in. root planted to root collar.
- Hole: 12-in. root, deep planted 4 in. above root collar.
- Hole: 8-in. root planted to root collar.
- Hole: 8-in. root, 1-in. top, planted to root collar.

1/ One inch above the root collar.

2/ Holes for the center hole method were dug with a planting mattock.

Seedlings planted on the cleared-forest site were grown at the now abandoned Clark State Nursery in Southern Indiana.

Fourth-Year Results

Planting method had little effect on fourth-year survival or growth (table 1). Regardless of the planting method used, survival was good and height growth was poor. Poor height growth may be attributed to lack of weed control.

The smaller seedlings survived as well as the larger seedlings, but the larger seedlings were taller after 4 yr (table 1).[3/]

Fertilization reduced survival and height growth. Average fourth-year survival ranged from 74 percent for fertilized

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3/ Robert D. Williams. Plant large black walnut seedlings for best survival and growth. Cent. States For. Exp. Stn., CS-38. 1965.

Table 1.--*Fourth-year survival and height by planting method and planting spot treatment on the cleared-forest site*

Planting method and seedling size	Planting spot treatment							
	Check		Simazine		Fertilizer		Fert. + Sim.	
	Survival	Height	Survival	Height	Survival	Height	Survival	Height
	Percent	*Feet*	*Percent*	*Feet*	*Percent*	*Feet*	*Percent*	*Feet*
10/32 INCH DIAMETER SEEDLINGS								
Mattock slit, 8 in. root, normal	90	3.2	95	4.4	80	3.0	80	4.1
Center hole, 12 in. root, normal	92	3.0	98	4.4	88	3.0	90	3.4
Center hole, 12 in. root, deep	92	3.0	80	3.9	65	2.4	65	3.1
Center hole, 8 in. root, normal	85	3.4	98	3.9	68	2.2	70	3.2
Center hole, 8 in. root, deep	98	3.0	92	3.3	75	2.5	88	4.6
Center hole, 8 in. root, 1 in. top	92	2.8	95	4.1	70	2.5	62	3.6
16-18/32 INCH DIAMETER SEEDLINGS								
Center hole, 12 in. root, normal	92	3.9	92	4.8	70	3.4	90	4.3
Center hole, 12 in. root, deep	98	3.5	90	4.0	65	3.5	80	4.5
Center hole, 8 in. root, deep	92	3.8	92	4.4	78	3.8	82	4.6
Center hole, 8 in. root, 1 in. top	95	3.5	95	3.5	82	3.5	88	4.5
Average of all planting methods	93	3.3	93	4.0	74	3.0	80	4.0

seedlings to 93 percent for those not fertilized (table 1). Mean height was 3.0 ft for the fertilized seedlings and 4.0 ft for those that received the simazine weed control treatment, either alone or in combination with fertilization.

The harmful effects of fertilizing walnut seedlings at planting time may be due either to the more vigorous overtopping vegetation stimulated by the fertilizer, or to the "burning" of seedling roots that come in direct contact with the fertilizer applied in the planting hole. Mortality was high in the fertilizer-plus-simazine spots but growth was not suppressed, indicating that root burn was the most likely cause of mortality in the fertilized spots.

Simazine alone did not increase survival over that of the check spots but controlling weeds did increase growth.

OPEN-FIELD PLANTINGS

Methods

Three open-field plantings were established on bottomland sites on the Kaskaskia Experimental Forest in southern Illinois in 1965, 1966, and 1967. The sites were plowed and disced before planting and competing vegetation was controlled by mechanical and chemical methods during the 4-yr course of the studies.

Seedlings for the open-field plantings were grown at the Jasper-Pulaski State Nursery in northern Indiana.

In 1965, 10/32-in.-diameter 1-0 seedlings and 14/32-in.-diameter 2-0 seedlings were planted. Roots of the 10/32-in. seedlings were pruned to 10 in. and those of the 14/32-in. 2-0 seedlings were pruned to 14 in. before planting.

In 1966 and 1967 only 1-0 seedlings in the 8/32-in.-diameter class were planted. Some of the seedlings planted in 1967 were infected with a root rot disease, and several died soon after planting. These and seedlings killed by an early spring flood were replanted by the assigned methods May 17, 1967.

With the exception of the 2-0 seedlings planted in 1965, planting methods were the same for the three open-field plantings:

Description

1965, 1966, and 1967 Plantings--1-0 Seedlings[4/]

- Bar-slit: 8-in. root, planted to root collar.
- Auger hole: 8-in. root, planted to root collar.
- Bar-slit: 12-in. root, planted to root collar.
- Auger hole: 12-in. root, planted to root collar.
- Auger hole: 12-in. root, deep planted to 6 in. above root collar.
- Bar-slit: 8-in. root, 3-in. top, planted to root collar.
- Auger hole: 8-in. root, 3-in. top, planted to root collar.

1965 Planting--2-0 Seedlings[5/]

- Auger hole: 14-in. root, planted to root collar.
- Auger hole: 14-in. root, 3-in. top, planted to root collar.
- Auger hole: 14-in. root, deep planted 6 in. above root collar.

1966 and 1967 Plantings--1-0 Seedlings[4/]

- Bar-slit: 8-in. root, laterals sheared to 1 in., planted to root collar.
- Bar-slit: 8-in. root, laterals sheared to 1 in., 3-in. top, planted to root collar.
- Auger hole: 8-in. root, laterals sheared to 1 in., 3-in. top, planted to root collar.

The seedlings were planted with planting bars or in holes bored with a tractor-mounted, 9-in.-diameter auger.

4/ 1-0 seedlings planted in 1965 were 10/32-in. diameter; 1-0 seedlings planted in 1966 and 1967 were 8/32-in. diameter.

5/ 2-0 seedlings planted in 1965 were 14/32-in. diameter.

In 1965 and 1966, each planting treatment was randomly assigned to six 10-tree rows in each block. Only five 10-tree rows of each planting treatment were planted in 1967.

In 1966, excessive spring rains and summer drought combined to kill many of the seedlings planted that year. Rainfall in April was 8.85 in. and in May 7.10 in., while rainfall in June and July was only 1.53 and 0.89 in., respectively.

Fourth-Year Results

Survival was related more to the year of planting than to planting treatment (table 2). Survival of seedlings planted in 1965 and 1967 by bar or in auger holes was about the same. However, in 1966 more bar-planted trees survived than trees planted in auger holes. Survival was reduced when secondary seedling roots were sheared to 1 in. before planting. The 2-0 seedlings planted in 1965 did not survive any better than the 1-0 seedlings, even though roots of the 2-0 seedlings were 4 in. longer. Top pruning had little effect on survival. Deep planting did not improve survival or growth. In fact survival of deep-planted seedlings was only 22 percent in 1966, poorest of any treatment in the open-field plantings.

Height and diameter differences among planting treatments were not consistent. However, 4-year-old bar-planted trees in 1966 and 1967 did show a height advantage (table 2).

DISCUSSION AND CONCLUSIONS

Results on the cleared-forest site and the open-field sites should not be compared directly because the plantings

Table 2.—*Fourth-year survival, height, and diameter of three open-field plantings on the Kaskaskia*

Planting method and seedling size	Year planted								
	1965			1966			1967		
	Survival	Height	DBH	Survival	Height	DBH	Survival	Height	DBH
	Percent	*Feet*	*Inches*	*Percent*	*Feet*	*Inches*	*Percent*	*Feet*	*Inches*
Bar, 8 in. root	97	10.3	1.4	80	9.9	1.4	84	10.6	1.4
Hole, 8 in. root	100	11.3	1.6	62	9.5	1.4	94	10.4	1.2
Bar, 12 in. root	94	9.7	1.3	70	10.1	1.4	96	12.4	1.8
Hole, 12 in. root	100	8.9	1.2	47	8.7	1.3	92	10.6	1.3
Hole, 12 in. root, deep planted	94	9.0	1.2	22	9.4	1.4	76	9.4	1.1
Bar, 8 in. root (3 in. top)	92	8.9	1.2	68	9.8	1.5	82	10.7	1.4
Hole, 8 in. root (3 in. top)	95	9.6	1.6	52	9.3	1.3	92	10.7	1.2
Hole, 2-0	100	9.7	1.2						
Hole, 2-0, 3 in. top	93	11.6	1.5						
Hole, 2-0, deep planted	87	10.5	1.4						
Bar, 8 in. root (sheared)				52	9.3	1.2	78	10.8	1.4
Bar, 8 in. root (3 in. top, sheared)				72	9.8	1.4	74	11.4	1.4
Hole, 8 in. root (3 in. top, sheared)				47	10.0	1.4	74	11.0	1.3

were made in different years, at widely separated locations with seedlings grown at different nurseries. Also, competing vegetation was controlled on the open-field sites, but not on the cleared-forest site. The greater height growth on the open-field sites does indicate the value of weed control.

On the cleared-forest site where weeds were not controlled, fertilization reduced survival and growth of the planted trees. Seedling roots probably were burned by the fertilizer salts that were placed in the planting hole, but it was apparent, too, that competing weeds, stimulated by the fertilizer, suppressed some walnut seedlings. Evidently, walnut seedlings should not be fertilized at planting time.

Simazine used in combination with fertilizer did not adequately control the weeds and woody vegetation stimulated by fertilization; however, simazine alone and in combination with fertilization increased tree height. Results from weed-control studies have shown that tree growth was increased most when the herbicides were applied annually for at least 2 yr.[6/] On the cleared-forest site, simazine was applied only once--immediately after planting--so weed control was not adequate.

There were no clear-cut differences in survival or growth among planting methods. However, in 1966, when early spring rains were excessive, bar-planted trees survived better than those planted in auger holes. It seems likely that water accumulated in the auger holes and drowned the newly planted seedlings. These results indicate that bar planting usually should be preferred to auger planting because bar planting is faster and cheaper.

6/ John E. Krajicek and Robert D. Williams. Continuing weed control benefits young planted black walnut. USDA Forest Serv. Res. Note NC-122, 3 p. North Cent. For. Exp. Stn., St. Paul, Minn. 1971.

Deep-planted seedlings survived and grew about as well as those planted at normal depth, but no better. So, because deep planting takes more time, and there's a possibility of root rot with no apparent benefits, we must recommend normal-depth planting.

Two-year results from a more recent planting-methods study showed that seedlings planted by machine survive and grow as well as those planted by other methods. However, it was necessary that a man follow the machine to straighten the stems and firm the soil around the seedling roots. Our experience with machine planting is limited to this one planting. So even though survival and growth of machine-planted trees were satisfactory, the method should be tested in other years, at other locations, and on different size seedlings before machine planting can be recommended for planting black walnut.

Stem pruning black walnut seedlings before planting had little effect on survival or mean height. This suggests that seedling stems could be pruned at the nursery to make packing and shipping of the faster growing, large diameter seedlings less difficult.

Two-year-old seedlings did not survive or grow any better than 1-0 seedlings. Although the added expense to produce 2-0 seedlings is not justified, nurserymen need not hesitate to carry surplus 1-0 stock another year.

Shearing secondary roots of black walnut seedlings caused a small decrease in survival, so shearing is not recommended.

These results indicate that the best planting method for black walnut is the one most convenient for the planter as long as it is compatible with the type of planting stock. The planting method can vary according to the equipment on hand, the size and topography of the site, the soil condition and existing vegetation on the site, and the size of the planting stock.

PESTICIDE PRECAUTIONARY STATEMENT

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 handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

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