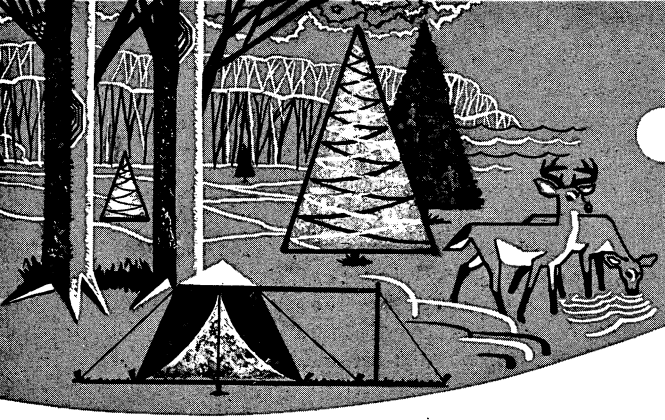

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PLANTED BLACK WALNUT DOES WELL ON CLEARED FOREST SITES-- IF COMPETITION IS CONTROLLED

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ABSTRACT.--After seven growing seasons, survival of black walnut seedlings planted in cleared forest openings did not differ by competition control treatments. The trees grew somewhat larger where all competing vegetation was controlled but almost as large where only herbaceous competition was controlled. Controlling only woody vegetation was no better than no control of any kind.

OXFORD: 232.324:181.41:176.1 (*Juglans nigra*) KEY WORDS: *Juglans nigra*, weed control, planting, herbicides.

Black walnut (*Juglans nigra* L.) planted in open fields grows well on good soils when weeds are controlled. Satisfactory methods of weed control have been worked out for open fields, but we did not know whether the same methods would work on cleared forest sites planted to black walnut. We found that black walnut plantings of excellent potential can be established under such conditions, but control of competing herbaceous vegetation is essential during early years.

THE STUDY

Black walnut plantations totaling about 1 acre in size were established in 1967 in Hardin County, Illinois, on the Kaskaskia Experimental Forest. The two small coves selected as planting sites were fairly well stocked with black oak (*Quercus velutina* Lam.), white oak (*Q. alba* L.), yellow-poplar (*Liriodendron tulipifera* L.), blackgum (*Nyssa sylvatica* Marsh.), American beech (*Fagus grandifolia* Ehrh.), and American elm (*Ulmus americana* L.) in the overstory; American beech and sugar maple (*Acer saccharum* Marsh.) were the most common understory species.

Soil on the study areas is mostly silty clay loam with Clarksville soils predominating but blending into Sharon and Belknap. Aspects include lower north and south slopes and cove bottom.

Two blocks of the study were located in one cove, and a third block in another. For each block we cleared an area approximately 200 feet square, cutting all trees and brush more than a foot tall. We removed all merchantable logs from the area, and pushed

the remaining slash into the isolation strip. Only the center portion of each cleared block was used in the study, leaving an isolation strip of at least 40 feet around the planted trees. All live stumps were treated with a low-volatile ester of 2,4,5-T.[1]

One-year-old black walnut seedlings from an Indiana seed source were planted. Although the top heights were variable, root systems were uniformly large. Roots were pruned to about 10 inches before hand planting in April.

Each block was divided into 12 plots, 30 x 36 feet. In each plot 30 trees were planted 6 feet apart, in 6 rows of 5 trees.

The treatments were intended to prevent shading of the walnut trees, because we assumed that light was the most critical factor in establishment and growth. However, after two growing seasons it was apparent that moisture was more critical than light. All walnuts were "free to grow," except in the check plots; yet the only favorable response was occurring where all competing vegetation was completely controlled. So, the study was modified to four basic treatments:

1. *All vegetation controlled.* For pre-emergence control, a mixture of equal parts of simazine and atrazine was applied at the rate of 4 pounds (total active ingredient) per acre. For follow-up later in the season, a mixture of 7 pounds of dalapon and 0.75 pound of 2,4-D amine (active ingredients) per acre was used. Simazine and atrazine were applied before the growing season, and dalapon and 2,4-D amine applied during the period of active growth.

2. *All grasses and forbs controlled.* A mixture of dalapon and 2,4-D amine at the same rates as indicated in "1" was used. Extreme care was taken to keep the chemicals off the woody stems.

3. *All woody species (except black walnut) controlled.* 2,4-D amine (2.5 ounces active ingredient per 10 gallons of water) was applied as a foliage spray. Extreme care was used to keep the spray from the forbs and grasses.

4. *No control of vegetation* (after clearing of the plots).

Some plots were treated annually, some biennially and some triennially. In addition, there were three untreated plots in each block.

SEVEN-YEAR RESULTS

Survival of black walnut was excellent for all treatments (94 to 99 percent). The small differences among treatment means were not statistically significant.

The walnut trees on plots where all vegetation or only forbs and grasses were controlled were notably larger than where only woody vegetation was controlled or where there was no vegetation control of any kind (table 1). Biennial control was no better than triennial, but annual control was superior. Where only woody vegetation was controlled, frequency of treatment had no effect.

After seven growing seasons, it was apparent that the competition among black walnuts on the best plots was overshadowing treatment effects, so we thinned all plots that had previously received vegetation control, removing half of the black walnuts (fig. 1). In addition, one of the three plots per block that had received no vegetation control was also thinned, and all vegetation killed within 3 feet of the remaining walnuts.

When the walnuts in the plots that were previously untreated were thinned and released, many fell over and had to be guyed with baler twine (fig. 2), emphasizing the need for early release with adequate growing space being continually provided.

[1] *Mention of trade names does not constitute endorsement of the products by the USDA Forest Service.*

Table 1.--*Development of planted black walnut and woody competition after five and seven growing seasons as related to type of vegetation control*

Table 1.

Treatments		No. of woody stems per acre[1]		Black walnut response			
				After 5 years		After 7 years	
Type	Frequency	5'+	0.5'+	Height (feet)	D.b.h. (inches)	Height (feet)	D.b.h. (inches)
All vegetation controlled	Annually	0a[2]	500a[2]	10.6a[2]	1.6	18.9a[2]	2.2a[2]
	Biennially	170a	2100a	7.4a-c	.9	11.8c-e	1.3cd
	Triennially	1000ab	3400ab	7.0a-d	1.0	14.3bc	1.5bc
Only forbs and grasses controlled	Annually	110a	1600a	8.5ab	1.4	17.5ab	1.8ab
	Biennially	890ab	2300a	6.7a-d	.9	12.7cd	1.3cd
	Triennially	4200bc	7400bc	5.6b-d	.7	11.7c-f	1.1c-e
Only woody vegetation controlled	Annually	0a	690a	3.4cd	0.3	8.3f	0.8de
	Biennially	90a	1100a	4.1cd	.4	9.4d-f	.8de
	Triennially	350ab	3800ab	4.3cd	.4	9.0ef	.9de
No vegetation controlled		6900c	13200d	4.1cd	0.3	9.9d-f	0.7e

[1]Counts and measurements made at beginning of fifth growing season.

[2]Values within a column followed by same letter do not differ significantly (5 percent level). Tukey's honestly significant difference test, from: Steel, Robert G. D. and James H. Torrie. 1960. Principles and procedures of statistics. 481 p. McGraw-Hill Book Company, New York.

Figure 1.--*Black walnut after thinning at the beginning of eighth growing season. All competing vegetation has been controlled annually.*

Figure 2.--*When released from competing vegetation for the first time at seven years after planting, these black walnuts required guying with baler twine to keep them erect.*

DISCUSSION

"Release" has been defined as, "...freeing a young stand of desirable trees, ...from the competition of undesirable trees that threaten to suppress them."[2] Although competition among trees for crown-growing space often necessitates release, the retarding effect of herbaceous vegetation on the growth of desired young trees is made evident by this study. Although foliage color was not measured, the difference between the yellow-green of the walnut leaves where competition was severe and the rich, deep green where competition was controlled clearly showed the adverse influence of competition.

It is impractical to consider controlling only forbs and grasses. Our objective was to separate the effects of competing forbs and grasses from those of woody competition. The results strongly suggest that in the early life of black walnut plantations the competition from forbs and grasses is much more critical than that from woody vegetation. The practical approach is to control all vegetation near the planted trees during the early years.

Where we controlled all vegetation annually (and where the best walnut growth occurred), there was some soil erosion. In practice, we recommend treating only that vegetation within 2 feet of each walnut. In addition we suggest planting trees at least 8 feet apart to minimize erosion. However, any encroaching vegetation on the surrounding untreated areas that is equal to or greater than the height of the walnuts should be cut back.

In converting stands of other hardwoods on good sites to black walnut there is one important question that this study did not answer: "How large should the opening be?" As mentioned earlier, the isolation strip was about 40 feet wide and the surrounding natural stand was about 80 feet tall. There was no evidence that the isolation strip was inadequate.

Assuming square openings and a need for a 40-foot isolation strip on all sites, a 1/5-acre opening would be about 93 feet across with only 2 percent of the area suitable for good growth of walnut. In a 1-acre opening (209 feet across), 38 percent of the opening would be suitable for good walnut growth, and in a 2-acre opening (295 feet across), 53 percent. An alternative would be to plant an entire opening and then enlarge the opening as walnuts become established, but before competition from surrounding trees becomes critical.

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[2] *Smith, David M. 1962. The Practice of Silviculture, ed. 7. 578 p., illus. John Wiley & Sons, Inc., New York, London.*

PESTICIDE PRECAUTIONARY STATEMENT

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