A paper written by J. R. Irwin, a forester in the Cambridge District of the Ontario Ministry of Natural Resources, to provide landowners with some guidelines for thinning black walnut (*Juglans nigra*) plantations.

Thinning Walnut Plantations

Much discussion has taken place in recent years, in our association, about thinning conifers. I have also done an item on pruning hardwoods and conifers. One of the subjects that I have not done, but for which there seems to be a need, is the thinning of walnut plantations. I say this not only because a member or two has said something like "I really should thin my walnut plantation". Over the years, I have been on the same property several times, have recommended a thinning, and each time I come back, nothing has been done. People seem reluctant, after having coddled trees for a number of years, to part with them. Also people want to get them to the point that someone else recognizes the value that the owner assigns to them, that is, is willing to pay for the wood. Unfortunately, this will not happen in the early stages of walnut management, i.e. first and second thinnings, and even into third thinnings.

Often, the landowner will prune all the trees, even to the point of pruning those trees which should be removed. This sometimes results in the most prevalent indicator of required thinnings: nectria cankers. Walnut trees that are crowded do not put on any significant diameter growth. Hence, when trees are pruned, the wounds do not heal. Often they are infected with *Nectria galligena* fungus which causes a characteristic target fungus. It is so called, because the fungus develops a see-saw battle with the tree, resulting in concentric rings of callous tissue around the old pruning wound, which then resembles a target.

So, how does one know when or how much to prune walnut? Whether the walnut was planted in a pure plantation, or in a plantation with conifer to produce a natural thinning, the following spacing suggestions can be adapted to evaluate, and if necessary, to thin your plantation.

Timber Production - For timber production, initial spacing of 10 feet by 10 feet is common. This type of plantation can be reduced from 436 trees per acre to 23 trees per acre through a series of five thinnings. The final spacing will be 44 feet by 44 feet when the average dbh is 23.4 inches.

Timber and Nuts - For this type of plantation, trees are initially planted at 15 by 15 feet. Thinning can be delayed until trees reach 5.6 inches dbh, and thinning then based on nut yield and quality as well as timber production.

Intercropping - Trees planted in rows within agricultural crops are normally at 5 feet by 30 feet, or 5 feet by 40 feet. This initial close spacing allows for selecting final crop trees.

NOTE: Walnut as a species, is highly variable in genetic quality. Realize that often seed was collected, under contract, from street trees that did not have the best form. Therefore, plantations were planted with sufficient trees to allow the poorer ones to be weeded out in favour of the good ones. For instance, some plantations are alternate rows of walnut and pine, with the walnut at a 6 X 14 spacing. Some walnut plantations are at a 5 X 20 spacing, with intervening rows of a nurse

crop species. This was done to allow genetic selection for the best trees. SOME TREES DO NOT HAVE THE GENES TO EVER MAKE GOOD TREES - DON'T WASTE TIME ON THEM.

Anyway, back to the formula. The following is derived from the "Managers Handbook for Walnut", an American publication from the North Central Forest Experiment Station, which resides in the Irwin archives. I used to have files, but now they are archives.

To use a measure of stocking to guide thinning decisions, you must select upper and lower CCF levels (Crown Closure Factor levels) between which stocking will be maintained. When the upper level is reached, the plantation should be thinned back to the lower level. the difference between the upper and lower levels determines how often thinnings will be required. The larger the difference between the levels, the fewer thinnings will be required.

Besides determining the upper and lower levels (of CCF), the following also must be known before decisions can be made as to when and how much to thin: (1) Number of trees per acre (2) Average dbh. If any two of these three variables are known, the third can be determined by using the conversion table below, and this formula: CCF = average crown area X number of trees per acre.

To calculate trees per acre, calculate the spacing and area per tree, and divide into 43,560 square feet per acre.

For instance, a 10 X 10 plantation is 43560/10X10 = 43560/100 = 436 trees per acre.

A plantation with walnut in every second row, 6 feet apart, in rows 7 feet apart (normal MNR spacing) would be 43560/ 6 X 14 = 43560/84 = 518 trees per acre.

If your trees are at an uneven spacing, or have been thinned before, you may have to take some measurements. You can put in a fixed area plot such as the 1/10th acre plots we used in the forestry training course. Tally the number of trees on 1/10th acre X 10 to give trees per acre, and average their diameters from your diameter tally.

For example, thinning decisions for a plantation initially composed of 436 trees per acre (10 feet X 10 feet) could be derived as follows:

Select an upper CCF level of 110, appropriate for veneer production, and a lower CCF level of 70 (after thinning - i.e. 70% crown closure). The 110 level would be divided by 436, which would give the average crown area of 0.252. This corresponds to the average tree size of 3.5 inches from the table. Therefore the first thinning on this plantation would be made when the average size of the trees reached 3.5 inches.

To determine how much to thin, however, it is necessary to estimate the average tree size after thinning. Based on the limited data available at this time, the diameter after thinning can be calculated by multiplying 3.5 inches by 1.04 and then adding 0.4 inches. Therefore, the estimated average diameter of the crop trees would be 4.0 inches

(This increase in average diameter, from 3.4 inches to 4.0 inches, simply because of a thinning, results because the smaller, poorer trees are taken out in the thinning, called "thinning from below".)

To determine the number of trees to leave, the lower CCF level of 70, would be divided by 0.298, which is the average crown area shown for a 4.0 inch tree in the table. This would show that 235 trees should be left.

Using the same procedure, a schedule for subsequent thinnings on this plantation could be set up as follows:

	Before Thinning	
Thinning	**Trees/Acre**	**Av. dbh**
1	436	3.5
2	235	5.6
3	131	8.4
4	73	12.1
5	41	16.9
Harvest	23	23.4

	After Thinning	
Thinning	**Trees/Acre**	**Av. dbh**
1	235	4.0
2	131	6.2
3	73	9.1
4	41	13.0
5	23	18.0
Harvest	-	-

This procedure can be used with all upper and lower stocking levels and any number of trees per acre.

(Don't you love American publications, figures area always in the Queen's (imperial) units: ironic isn't it?)

Tree Crown Area
(In percent of an acre)
(Simplified table for dbh's averaged to the nearest half inch)

Diameter at Breast Height

Inches	Tenths of inches	
x	x.0	x.5
1	0.085	0.111
2	.142	.175
3	.212	.253
4	.298	.345
5	.397	.452
6	.511	.573
7	.639	.708
8	.781	.858
9	.938	1.022
10	1.109	1.200
11	1.295	1.393
12	1.494	1.600
13	1.708	1.821
14	1.937	2.056
15	2.180	2.306
16	2.437	2.570
17	2.708	2.849
18	2.994	3.142
19	3.294	3.449
20	3.608	3.770
21	3.937	4.106
22	4.280	4.456
23	4.637	4.821
24	5.009	5.200
25	5.394	3.593
26	5.795	6.000
27	6.209	6.422
28	6.638	6.858

CCF = (table value)(number of trees per acre)

$$\text{Table value} = \frac{\text{CCF}}{\text{number of trees per acre}}$$

$$\text{Number of trees per acre} = \frac{\text{CCF}}{\text{table value}}$$

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