19. Selecting Crop-trees:

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This chapter was originally titled “Thinning”, but the name was changed, because thinning is not the right mind-set for what we want to accomplish. There is nothing wrong with thinning. The usual thinning is fast, efficient, and involves reducing the general tree population density by taking out poor trees. A different approach is appropriate here because we have created unusually tall, slender, and valuable trees. Our approach here is strictly focused on crop-trees, so this chapter describes identifying crop trees, and the next chapter describes how to keep them growing at full speed. Since our time is dear, we’ll completely ignore the non-crop trees (until they bother crop trees)

If you have followed our recipe for starting a black walnut planting with dense basal shading, it will be difficult and unnecessary to enter the planting for several years. The lower branches of the trainers are interwoven – exactly as we want. When the battle for light moves upward and lower limbs are dropping, you’ll be able to enter and have a look around. Before that, you might crawl in, monitor progress, and correct few obvious problems.

There will be a variety of results, lots of beautiful stems, but some trees are being squeezed to death. These walnuts are not clones. Some individuals will like this environment, and some will need help. Luckily, there are a lot more trees than necessary.

Figure 1. A typical pattern of growth. Interior trees with lower shading have better form. Edge tree with less shading show poor stem form. This planting is a walnut monoculture, so the trees have been manually pruned and corrective scars are visible.

The final crop-trees need to be pampered and get canopy priority.   To conserve our precious time and effort, the focus should be only on the fraction that will end up as crop-trees and ignore the rest. Obviously, an early activity should be identifying and marking the crop-trees, but first we should take a short detour and consider marking.

<u>A.   Tree Marking</u>

Jerry Van Sambeek has brought to our attention, that there is evidence of cambium injury from tree marking paint. The case in point was on young sugar maple marked with boundary paint (oil-based).

We haven't heard of damage on black walnut, but we are talking about <u>all</u> the most valuable trees we have. True or false, it doesn't seem worth the risk of using oil based paint on crop-trees. In any case we first identify the crop-trees with blue ribbons.

Use Water base tree marking paint (above) on crop-trees. Water base has easier clean-up, it is all-around safer to use, and you get to stay inside in freezing weather. Nelson Hydro Spot is water based and still visible after 5 years, however their cans don’t stand up to tractors. The markings will need to be reapplied when they eventually fade.

B. Color Standards

Over the years it has been helpful to adopt some personal color standards for marking paint and colored ribbons. We avoid darker colors which are not very visible on the black walnut bark. Our standard goes like this:

White = Layout – like every 10th row and 10th column - for when we are lost.

Blue = Crop-trees and double blue bands for "select" trees and seed gathering "blue for royalty"

Red = Cull trees to be killed "red is dead"

Yellow = nut producers – thin shelled cultivars

Orange = Survey sample measurement trees.

Black = Eraser

At left, a select black walnut. Selects should be no more than one in a hundred crop trees. Above is Nelson Hydro Spot marking after 5 years

C. Identifying Crop-trees

C1. The Forester Method:

You can engage a forester to come and identify the crop-trees. It will be fast, and this work is a forester's life and strongest suit. No advice is needed. You can skip the rest of this section. However, if you are left-brained, (like me, and need to do it yourself) read on.

C2. The Best-of-N Method:

Assuming a partial harvest of 35 trees per acre and a final harvest of 35 per acre, a good number for crop-trees plus plenty spares would be around 80 trees per acre total. If at the current stage there are 320 trees per acre, then 1 in 4 should be a crop tree, i.e., N = 4. So, walking down a row and select the best of every 4 trees.

N	pure	restart
1	100%	100%
2	50%	67%
3	33%	50%
4	25%	40%
5	20%	33%
6	17%	29%
7	14%	25%
8	13%	22%
9	11%	20%
10	10%	18%
11	9%	17%
12	8%	15%
13	8%	14%
14	7%	13%
15	7%	13%
16	6%	12%
17	6%	11%
18	6%	11%
19	5%	10%
20	5%	10%

It could be that simple, but foresters like to restart the count just after a chosen tree. So, in the case of N = 4, the first 4 trees in a row are examined. Let's say #2 is the best. The next set to consider is 3, 4, 5, and 6. Trees # 3 and 4 get two chances of being picked. The restart method is more likely to choose adjacent trees, which is a good idea. As opposed to the "pure best-of-N" method, the "restart best-of N" method does not select 25 percent for N = 4. The table at the left gives the percentages selected for various values of N for both pure and restart approaches. Use N = 7 to get 25% with the reset approach.

C3. Best-of-L Method

While selecting crop trees at Curtis Peters' planting in southern Indiana, a problem with Best-of-N was apparent. The planting had some areas where black walnuts were sparce. It was common sense that almost every tree should be marked a crop tree. This whole process is about wisely divvying up an acre's canopy to around 80 crop trees. So, each future crop tree should get an acre, 43560 sqft., divided by 80 trees = 545 sqft. Of canopy per tree. If the row spacing is 12 feet, each crop tree should average 545 / 12 = 45 feet (15 paces) of row length. I guess this method should be called "best-of-L". The best-of-N will be easier if the tree density is relatively uniform.

> Note: For the home stretch to harvest we need bigger crowns and around 35 trees per acre. Half of the pole-size trees selected here will need to go at age 50 or before. Don't bother to decide the final crop trees until the partial harvest time. Then sell the poorer half of the tree and keep the best. Don't let the logger decide. He will take the best and leave you the worst.

The Pence Sanity Rule:

"If there is a better unmarked tree nearby, you can move the ribbon, but you can't put it in your pocket, or add ribbons."

Whichever of the three methods described above we use, during the first pass we mark crop trees temporarily with a blue ribbon. Then we make a second pass to apply the Pence sanity rule, might move a ribbon, and permanently mark the crop trees. Final crop trees can reach a long way for canopy, so look around in all directions for a better unmarked tree within a reasonable crown reach. If one is found, "**pence**" (*v. to move a ribbon*) it.

C4. Rule of 35/35 Method

Most hardwood trees are growing in a natural arrangement, not in rows, so the "best-of- _" methods described above will not work in natural settings. Timbers Stand Improvement (TSI) specialists choose crop trees in natural settings every day. A common method used is the rule of 35/35. A square 35 x 35 feet is close to $1/35^{th}$ of an acre. If one tree is selected in every 35 x 35 block, that gives 35 trees per acre. Two trees per block results in 70 tpa, which is a good target for pole-size black walnuts crop trees.

It is easiest to start off with a 35-foot band next to an edge. Pace off 35 feet along the band and leave a marker. Go back and permanently mark the best two trees in the35 x 35 blocks. There is no need for Pencing or to make a second pass. You will soon be able to judge 35 feet, but you might still get off track in a big woods. For speed and economy, foresters mark trees with a paint dot, not a ring. In a given 35-foot band, put all the dots toward the next band so they can be seen and the next band will not get off course.

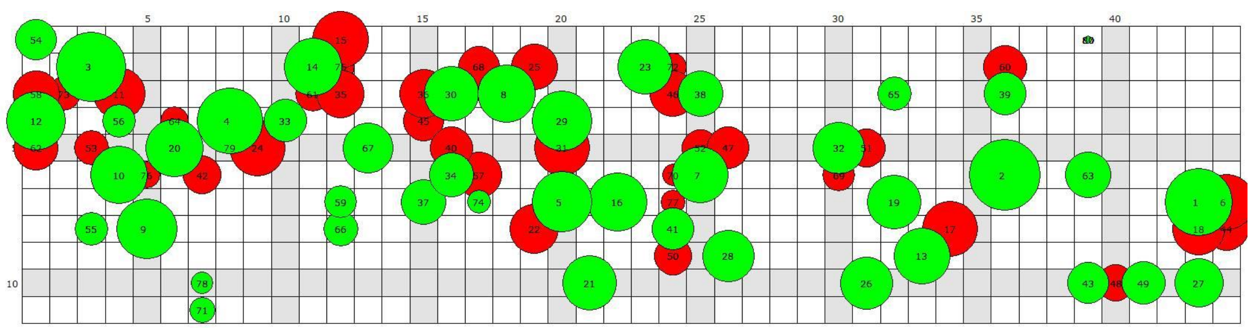
What is meant by "better" or "best"? That is where foresters have you beat. They have seen thousands of trees grow and their logs opened. They can classify "best" at walking speed without thinking. For picky details about estimating the relative potential value of pole-size black walnut trees see Appendix 19A.

C5. The Virtual Chainsaw Simulator Method:

In a square grid planting, I walked around with spools of blue ribbon considering adjacent rows and became very confused. This was a job for a computer. My exasperation in the woods led to creation of the Thinning Simulator Method and Program, aka The Virtual Chainsaw". This is far-left brained.

The Thinning Simulator Method works as follows: First you need a coordinate system so we know where everybody is located – GPS will work. The diameter (DBH) is measured, along with the estimated potential veneer lengths and quality for each tree. Other species trainers and obviously losers need not be measured. The measured data is entered into a spreadsheet. In the spreadsheet a relative value is computed from the entered measurements for each tree. Then the trees are sorted putting the most valuable tree at the top of the list. The essential work is all done by ranking the trees by value in the spreadsheet.

The Thinning Simulator Program (affectionately call "The Virtual Chainsaw" or "VC") loads the spreadsheet. With the VC program, the user can choose the number of crop trees desired per acre and run the selection process. The program determines each tree's fate. The results are shown as a plot diagram and several forestry metrics, including crop trees-per-acre. When satisfied with the results, we can ask for a plot map, a printed report, or both to take to the field with our blue ribbons – no decisions to make – no stress.



The Thinning Simulator Method is time consuming, very educational, extremely accurate, and puts off any physical work for a while. The detailed Thinning Simulator Method Instructions can be found under "Black Walnut" on the http://www.thescalepit.com/ website.

To summarize: To maximize forest value, we need to know which trees to pamper and which to ignore. We have mentioned five methods for identifying the crop-trees: get a forester to do it; the Best-of-N or Best-of-L; the Rule of 35/35; or the Thinning Simulator Method.

Appendix 10A – Estimating the Relative Potential Value of Pole-Size Black Walnut Trees.

To be objective about scoring young black walnut trees, we must visualize the big tree at harvest time with the current tree at its core. Veneer buyers know every tree had to have limbs when it was young and the center of every veneer log has veneer defects. The veneer yield depends on how big the log is and how big the defective center is. The prime material is always outside the core, like a donut of clear wood.

It should be assumed that crop trees will be allowed to grow big, say 30 inches. Then the center defects will be hidden, long buried in beautiful sound wood. Even the knobby pruned youth at the left will become worthwhile for veneering at age 90.

Tree Score Calculation:

In preparing the spreadsheet for the Virtual Chainsaw program, a tree score is computed proportional to potential veneer volume. Normally the score is the DBH squared times potential veneer length. DBH is easy to mesure, but potential veneer length takes some imagination. Potential veneer length is from the stump up to some "veneer show stopper", which will still be visible at age 90. Show stoppers can be a crotch, a big limb, lean, sweep, or a crook. The tree at the left should be entirely useful to the very top. The tree will continue to grow in height and all the current branched will be shed by canopy shading.

Quality:

The quality is the final veneer yield, i.e. how big is the defective center, the donut-hole, compared to the whole volume. What is the diameter of an imagined cylinder that just contains all the central defects? The 9-inch DBH tree on the left has all its pruning defects recently healed over. From now on it should produce only sound wood. A 9-inch cylinder should encompass all its sins.

Veneer Yield from a log with defects within a cylindrical core

Harvest Diameter*

Core Diameter**	14	16	18	20	22	24	26	28	30	32	34	36
4	92%	94%	95%	96%	97%	97%	98%	98%	98%	98%	99%	99%
5	87%	90%	92%	94%	95%	96%	96%	97%	97%	98%	98%	98%
6	82%	86%	89%	91%	93%	94%	95%	95%	96%	96%	97%	97%
7	75%	81%	85%	88%	90%	91%	93%	94%	95%	95%	96%	96%
8	67%	75%	80%	84%	87%	89%	91%	92%	93%	94%	94%	95%
9	59%	68%	75%	80%	83%	86%	88%	90%	91%	92%	93%	94%
10	49%	61%	69%	75%	79%	83%	85%	87%	89%	90%	91%	92%
11	38%	53%	63%	70%	75%	79%	82%	85%	87%	88%	90%	91%
12	27%	44%	56%	64%	70%	75%	79%	82%	84%	86%	88%	89%
13	14%	34%	48%	58%	65%	71%	75%	78%	81%	83%	85%	87%
14		23%	40%	51%	60%	66%	71%	75%	78%	81%	83%	85%
15		12%	31%	44%	54%	61%	67%	71%	75%	78%	81%	83%
16			21%	36%	47%	56%	62%	67%	72%	75%	78%	80%

* Harvest diameter inside the bark at the small end (inches)

** Cylindrical core diameter which contains all defects (inches)

Table X. From the table above, our 9" knobby tree will be 90% clear volume when it reaches 28 inch diameter.

There are some important lessons apparent from this table. Early pruning makes a small core diameter, which is very important if tree is to be sold at small diameters. A 16-inch tree would need to be all healed up by 4 or 5 inches to give a reasonable veneer yield. However, a 36-inch tree can contain a big ugly core and not seriously affect the veneer yield. A veneer buyer has less risk and consequently pays more for big logs. A tree's quality rating should be based on the veneer yield for its ugly core diameter assuming some big harvest diameter.

During thinning, by whatever method, we all end up comparing the relative value of nearby trees. Since we assume final crop tree will be allowed to get big, the ugly core diameter is not so important. For measurement speed on pole-sized trees, we have quit using any quality rating and just settle disputes between adjacent trees based on diameter and merchantable length.

The Virtual Chainsaw methods demands math. The tree score is computed as merchantable height times diameter squared: $S = H * D^2$.

Figure 7. This slab shows many years of veneer quality growth covering the donut hole of an ugly youth.