Using Trainers to Naturally Shape Black Walnut Trees

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Bill Hammett's recent Walnut Council *Bulletin* article states that the physical shape of a black walnut tree is the result of exactly three influences: G, E, & M, Genetics, Environment, and Management. For most of us black walnut growers, our objective is timber production, ideally veneer. We would like to do as little "M" as possible. A lot of effort has gone into improving black walnut's "G". However, this article is about manipulating the tree's "E" to persuade the trees to grow in the shape we want to fulfill our veneer timber objective.

Too Little Shade:

As a starting point, it is good to examine how the black walnut tree wants to grow. Given the freedom to grow in the open, the tree will spread out as far as mechanics allows, collect as much sunlight as possible, and cover the ground with nuts. Figure 1 shows the shape resulting from extreme no-shading "E" for a black walnut tree grown in the open.

Figure 1. If you want to produce black walnut nuts, or have a picnic, a tree like this is the ideal shape. The side branches have been exposed to light and have grown large and healthy. This beauty will produce zero timber

Too Much Shade:

The opposite "E" extreme is too much shading which will kill the shade-intolerant black walnut trees. Specifically, light levels lower than 24% will kill black walnut's leaf-bearing tissue, including leaves, branches, or even whole trees.   Figure 2 shows a black walnut tree that struggled to keep up with surrounding white pines for several years, but was eventually overtopped and did not survive the shading.

Figure 2. A winter-time photo showing a "lollipop" black walnut tree that too slender, failed to compete, and was shaded out by surrounding white pines.

Just Right Shade:

Veneer quality black walnut trees do exist, and are found in a deep forest setting exposed to some intermediate level of shading. That magic veneer producing shading level is dangerously close to the lethal shading shown in Figure 2. Figure 3 shows the early stage of a black walnut tree destined for veneer use.

Figure 3. If you want to produce black walnut timber, or better yet, black walnut veneer, a tree like this is an ideal start. This tree is untouched – zero "M". It has been cleared of side branches and challenged upward by shading from surrounding conifers. This tree is threatened by the shading, and its main concern is survival. It will produce very few nuts and see very few picnics.

The tree form for nuts, Figure 1, and the form for timber, Figure 3, are so dissimilar, they can look like different species. **The dual-purpose black walnut (both nuts and timber) is a myth.** It is hard to believe that tweaking the "E" can have such dramatic effect on the tree's form, but given the different "E", the figure 1 tree would have grown just like figure 3 – and vice-versa.

Consider the lower side branches on the young black walnut in figure 4. There are seven, ½ inch diameter side branches. If we do nothing, they will grow outward to form a fat tree like figure 1. To make a veneer stem, these side branches need to be removed now, not after they grow to 2 inches. Half inch branch scars soon become covered by normal bark pattern and hidden from the x-ray vision of future veneer buyers.

The removal could be done manually with pruner shears, or naturally by shading. To shade these branches the dense shade of the "trainer" tree needs to be close by, just above the side branches, but not bothering the top of the tree. Developing a solid plan for the geometry and timing to do such natural pruning is the objective of the Walnut Council supported experimental planting on Blennerhassett Island in West Virginia.

Several earlier plantings in the Midwest have been made using conifers as walnut trainers. About half of these have been failures for various reasons – mainly timing and site issues. The site needs to accommodate both the walnut and the trainer species.

***Figure 4. A young black walnut at the crossroads of sha*ping**

An Unmanaged Closed Canopy Black Walnut Monoculture:

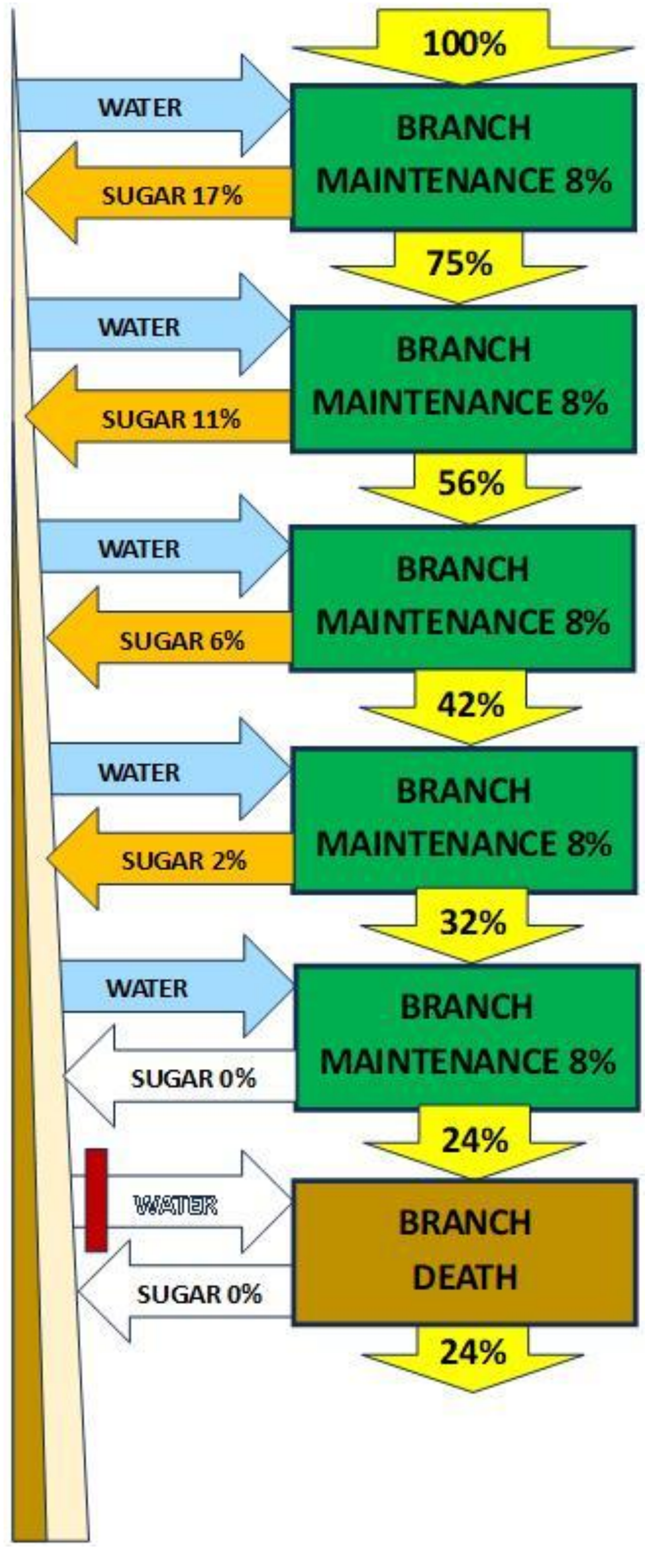

Figure 5. A symbolic diagram showing energy flow downward (sunlight = yellow arrows) through the crown of a black walnut tree in a closed canopy monoculture. The walnut canopy's foliage is divided into 5-foot layers, each with sap consumption (blue arrows) and excess energy production (orange arrows). (My numbers might be right, and I'm stickin' with them until proven otherwise.)

In figure 5, the topmost 5-foot layer of the canopy receives full 100% sunlight energy. The layer's sparse foliage intercepts 1/4th of the incoming solar energy, and 3/4th passes through to the next layer downward. Some captured energy, 8%, is used within the layer for tissue growth and maintenance. Excess energy, 17%, is passed inward to the trunk in the form of sugar. The branches of the layer get needed water and minerals from the trunk.

The lower layers operate the same way, but each lower layer going downward gets progressively reduced sunlight. The fifth layer down (25 feet from the top) gets so little sunlight that it supplies no excess energy to the tree. Trees do not tolerate nonproductive branches. The supply of water and nutrients is blocked (red box) deep inside the branch collars causing branch death.

As the tree grows, new small branches form at the top and old large branches die at the bottom of the canopy. The 25-feet of living canopy appears to move upward. The large dead branches at the bottom and their knots in the trunk are veneer show-stoppers. **Black walnut has no interest in lumber, and is lousy at naturally pruning black walnut for veneer.**

What if we continuously pruned at a point 10 feet down from the top, keeping only the top two layers in figure 5? The top two layers produce most of the tree's sugar energy, and the branch diameters 10 feet down is much smaller than diameters 25 feet down.

The Blennerhassett Experimental Plan:

Continuously pruning off side branches at a point 10 feet from the top, will give the clear stem we want without much loss of growth rate. The pruning is usually done manually, unpredictably, and gets difficult beyond the reach of a pole saw. Why not use other tree species with dense foliage to do the pruning for us? That is the objective of the Blennerhassett project - to develop a solid practice whereby growers can confidently produce veneer quality black walnut timber in a plantation setting, while their pruning shears rust away in the garage. We start by planting the surrounding conifer trainers, then find the optimum delay for planting the black walnut crop trees in the midst of the growing trainers.

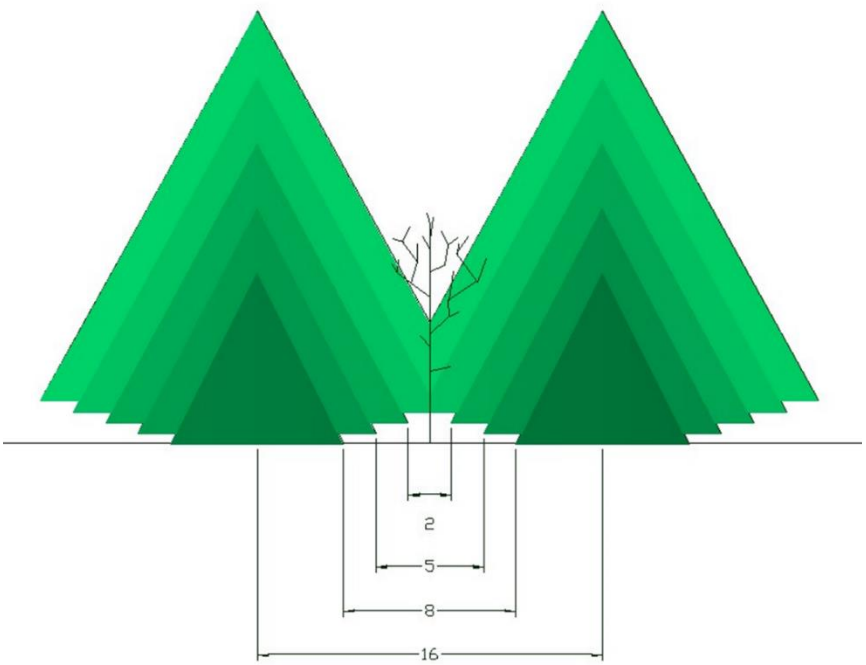

Figure 6. A diagram showing the ideal geometric target of Blennerhassett experimental planting. At the ideal spacing and timing, the conifer trainers shade out the side branches of a young black walnut, but do not obstruct its growing top.

Figure 6 shows conifer trainer growth closing in on a young black walnut. The challenge is to figure the planting lead-times so the trainers and walnuts both arrive at figure 4's target arrangement at the same time.

Bald cypress conifer trainers were planted in the spring of 2021 in rows 16 feet apart. To give the trainers a head start, the black walnut plantings between the trainer rows were delayed 0, 3, 4, and 5 years. The closing aisleway width between the approaching trainer foliage was recorded at the time of planting for each walnut tree. These closing aisleway widths varied from 16 feet opening (for no delay) to zero opening (yes, a few walnut trees were planted right under a live cypress branch).

Results:

Figure 7. This 1.5-year-old black walnut seedling on Blennerhassett Island was planted 3 years after the surrounding bald cypress conifer trainers. This resulting geometry is close to our ideal preconception as shown in figure 6.

Figure 7 shows a happy result typical of many of the young Blennerhassett walnuts. At the outset in 2021, it was assumed that waiting for 5-foot aisleways would be the ideal planting delay. The experimental plan bracketed our 5-foot best guess for the walnut planting delays. Now, those with small delays are under-trained and branchy. Some with long delays are overtopped and doomed. **The closing trainer aisleway width turns out to be a more effective walnut planting-time guide than fixed years-of-delay**.

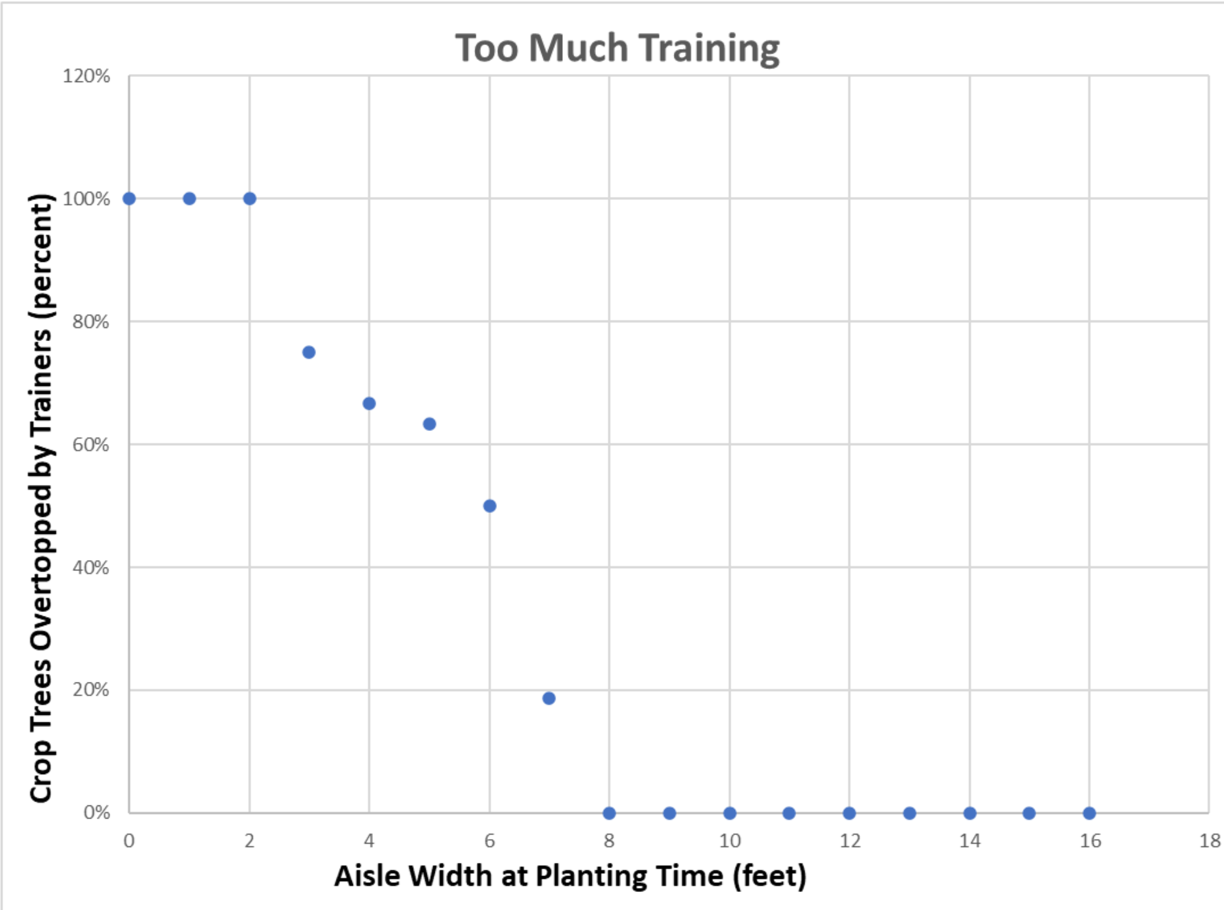

Figure 8. The percentage of young black walnut seedlings overtopped (and likely doomed) by approaching bald cypress trainers vs. the width of trainer aisleways at each walnut's planting time.

The graph shown in figure 8 combines aisleway width data collected over the years at planting time, with overtopped observations midyear 2026. The data set includes about 120 walnut seedlings. Our preconception was that planting in 5-foot aisleways was the best answer. We were not expecting to get such meaningful results so soon - year 6. At the most recent measurement, none of the black walnuts planted in aisleways 8 feet or wider had been overtopped. Planting in aisleways 5 feet wide or less is too late, too crowded, and likely fatal to the overtopped walnuts. We want to threaten the young walnuts, but not quite kill them – tough love. If this were all the information available, then the best walnut planting time is when the trainer aisleway closes to around 8 to 10 feet. If we wait any longer, some walnuts will be overtopped and not survive the dense cypress shading. Earlier than ideal planting would be safer, but result in under-shaded uglier trees – time will tell.

Future Plans:

Figure 9. Aerial view of Blennerhassett experimental blocks 9 through 13. Two blocks on the left are black walnut monoculture controls planted in the spring of 2021. The three blocks on the right are bald cypress trained experimental blocks. A few green dots (delayed walnuts) are peeking up between the trainer rows. They will need to hurry to catch up with their non-delayed brethren in the left two blocks. (Aerial photo courtesy of David McGill)

1. Another way to arrive at the timing shown in figure 6 would be to plant both the trainers and the walnuts at the outset of the project. The young walnuts would start out untrained and limby. Then when the trainer aisleways closed to 5 to 8 feet, coppice all the walnuts. The new shoots should shoot up with vigor and arrive at the ideal geometry shown in figure 6. This idea will be tried with a few non-delayed walnuts.

2. The plan has been that all the trainers will eventually be killed standing in place. It has become apparent that half the number of bald cypress trainers would have given similar training results. Where a few cypress trees were accidentally missing, the resulting aisleway looks about the same as the 8-foot in-row spacings elsewhere. If this assumption is correct, it would save half the cost and labor associated with the trainers. Thanks to failed white pine trainers, the space for 6 new blocks became available. In these new blocks, the outside rows of bald cypress trainers were planted in the spring of 2024 with 8 foot in-row spacing. To test the assumption, in half of these new blocks, every other cypress will now be removed to produce a 16 x 16 trainer spacing.

3. This year it was decided to flip the black walnut monoculture control block policy from "don't touch" to "best management". The "don't touch" policy is typical for "G" progeny testing, but we need to show that our new growing method, "E", gives better results than the usual best current recommended growing practice, (lots of "M"). If we can't produce better trees than the best current practice, we need to fold our tents and give up. The new policy will begin on control block crop trees during dormancy this winter.

4. In the 6 new blocks, after 3 growing seasons, the aisleways between these trainers has closed roughly to 10 feet. The results shown in figure 8 suggests it is time to plant the walnuts. More data samples will be helpful in 8-to-12-foot trainer aisleways range. The walnuts will be planted in the 6 new blocks next spring, and the trainer aisleway widths for each walnut seedling will be recorded at planting time.

Other Blennerhassett Revelations:

1. Trees grow according to G, E, and M, not spreadsheets.
2. 3D electric deer fence worked perfectly for 2.5 years, then suddenly failed perfectly
3. 7-foot mesh fence will not stop an Ohio River flood.
4. Blennerhassett deer are a tad tall for 5-foot tree tubes
5. Most conifer species do not survive above pH 6.5. The site's pH of 7.3 is okay for both black walnut and bald cypress.
6. Beavers happily coppice both bald cypress and black walnut, and they don't leave a mess.