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Carpinus caroliniana Production at Johnson's Nursery, Inc.®

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Carpinus caroliniana is a small understory tree, 20 ft to 30 ft tall and wide. It is found in lowland woods from Nova Scotia to Minnesota and south to Texas and Florida. The plant is prized for its muscular-looking trunks of slate gray bark. The common name musclewood comes from this interesting characteristic.

Fall color can be outstanding. Some trees develop glowing reds, oranges, or clear yellows. Unfortunately, many other individuals have disappointing dirty yellow to brown fall color.

Musclewood is seldom used in the landscape industry. One reason for this may be its reputation for being difficult to grow. Eighteen years of growing experience with this species has proved otherwise. This plant is not difficult; it is just not understood.

Musclewood is slow growing but growth can be accelerated in the production process by avoiding inbred seed lots. The species is definitely slow to recover from either bare root or B&B transplanting, however, our nursery has rarely lost plants due to transplant. There are many other taxa, such as *Quercus*, *Corylus*, *Crataegus*, and *Amelanchier*, which could be considered more difficult to transplant.

Musclewood performs best when grown in full sun, in deep rich soil with a steady moisture supply. The species will survive in some surprisingly tough sites. I have seen plants growing successfully as street trees in relatively hot, dry locations. Musclewood has tolerated high pH nursery soils, (pH 7.2 to 7.6), with no noticeable ill effects. Many of the problems with growing *C. caroliniana* may be overcome by selecting and

developing a proper seed source. Seedlings of Tennessee provenance suffer winter dieback or death in our nursery. In addition, fall color has been non-existent on seedlings from southern sources. Local northern seed sources are best for use in southeast Wisconsin. Fall color can be both spectacular and poor on *C. caroliniana* grown from local seed sources. Oftentimes they will have a high percentage of individuals with poor fall color — up to 70% or more. When seed is available, we can be selective and pick seed only from plants with orange or red fall color. By doing this we are able to reverse the percentages, having about 70% or more of our plants with good orange-red fall color and only about 30% or less with poor fall color.

Much of the wild-collected seed in southern Wisconsin may be inbred. I suspect a problem because seedlings grown from our sporadically distributed wild populations lack vigor. Most 1-0 seedlings from these wild sources grade out to 3 inches to 6 inches tall. When seedling plants from these isolated genotypes are brought together and allowed to cross-pollinate, the resulting seedlings show a dramatic increase in vigor. The 1-0 seedlings from these hybrid seed lots will average 6 inches to 12 inches tall with some being 12 inches to 18 inches and a few 18 inches to 24 inches. The leaves on the hybrid plants are often 25% larger than those of wild-collected sources. The possible inbred nature of a seed lot should be considered when growing *C. caroliniana*.

We collect seed in mid- to late September, just as musclewood starts showing fall color. The small nutlet part of the fruit is still green. The surrounding bract may or may not be turning color or may be a dry tan-brown at this time. Cutting tests are done on the seeds of each individual plant before picking. Within a block of mother plants the percentage of viable seed can vary tremendously from plant to plant.

The seed is stratified immediately after picking. The fruit clusters, bracts and all, are put in a sand and peat mixture (1 : 1, v/v) and placed in plastic bags. The bags are stored in an unheated insulated building until planting. To improve our chances for success, half of the seed is fall planted and the other half is planted the following spring.

The seed is hand planted in raised beds of sandy-loam soil. The beds are not fumigated or treated with any fungicides. We use well-rotted hardwood chip compost as a seed cover. Seedlings are shaded with 55% saran shade cloth during the first season. The shade is removed around 15 Aug. The beds are fertilized by incorporating slow-release Osmocote Pro 20N-4P₂O₅-8K₂O before planting. Starting in early May, a foliar feeding of 20N-10P₂O₅-20K₂O with trace elements is applied weekly. Leafhoppers, the primary pest problem, are controlled with insecticide sprays about every 2 weeks.

The 1-0 seedlings are dug by hand in fall after leaf drop. They are graded, counted and bundled. Before freeze-up, the plants are heeled-in in beds of aged sawdust and placed in an unheated, insulated building. They freeze solid for the winter.

The following spring the 1-0 seedlings are bedded on 6 inch × 6 inch centers. We will dig these plants when they have developed into heavy 6-inch to 12-inch transplants. For most seedlings this usually occurs after a period of 2 years. The plants from hybrid seed sources grow faster and allow us to dig 6-inch to 12-inch transplants after only 1 year.

We grade the transplants into types suitable for tree-form production or shrub-form production, based on the presence or absence of a strong central leader. Only tree-form production will be discussed in this paper.

Transplants are lined out on close row spacing (1 ft × 5 ft). Fertilization consists of a pre-plant P and K adjustment as dictated by soil tests. Each year we apply 150 lb of slow-release 20N-0P₂O₅-0K₂O in split applications, one in late spring and another in early fall. No staking, pruning, or training is done the 1st year in close rows.

At the beginning of the second year of growth in close row spacings, trees are whipped, staked, and tied. They are not cut back to train a single bud up a stake since musclewood does not respond to hard pruning. Instead, they are trained up the stakes throughout the season to maintain a straight leader. We remove any large side branches as soon as they begin to dominate, leaving all small caliper side branching. *Carpinus caroliniana* is hard to develop into a tree form without this judicious pruning.

On a limited basis, we have been successful using 4-ft-tall Tubex tree shelters to increase the rate of height development and to decrease the amount of heavy side branch development. We place the shelters over the trees at the beginning of the 2nd year in close rows. An important step in this process is to remove the shelters as soon as plants reach 4 ft tall or before 15 Aug., whichever comes first. If the shelters are left on too long, the result is excessively spindly plants, and a greater susceptibility to winter dieback.

The plants spend 3 years in close rows. Throughout this production period we must protect the trees from rabbits. Musclewood are a favorite winter rabbit food.

During the 3rd year in close rows, training and tying continues and all branches on the bottom one-third of the trees are removed.

Early in the following spring, the plants are dug bare root. They will typically grade out as 4 ft branched, 5 ft branched, and 6 ft branched. The musclewood liners are root pruned, and the branches are thinned and headed back about halfway. The leader is maintained. Plants are then lined out on 5 ft × 10 ft spacing.

Three years later, 1¼ inch to 1½ inch B&B trees become available for sale. One year after that, 1½ inch to 1¾ inch trees can be harvested.

Musclewood is one of our finest small native trees. By developing improved seed sources and refining liner-growing techniques, this wonderful species should become more available in the landscape industry.