

## Progress in *Carpinus caroliniana* Propagation and Selection<sup>©</sup>

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In 2001, in Lexington, Kentucky I presented a paper for the IPPS — Eastern Region entitled, “*Carpinus caroliniana* Production at Johnson's Nursery, Inc.”. I would like to give you a brief review of that work and update you on the new developments I have encountered in the last 12 years.

### PROPAGATION AND PRODUCTION

#### Seedling Production

Over the past 32 years, through Johnson's Nursery in Menomonee Falls, Wisconsin, I have worked on developing a seedling strain of *C. caroliniana* that has a high percentage of seedlings (70%+) with brilliant orange-red fall color for the Upper Midwestern part of the country. It has been called *C. caroliniana* J.N. Strain. This strain has incredible vigor when compared to seedling plants grown from wild collected seed from our area. Because of this, production times for this species have been significantly decreased at our nursery. It takes 2 years less to finish a 5 ft shrub form B&B plant than it did when we used wild collected seed from what we had suspected were inbred ecotypes in the mid-80s (Figs. 1 and 2).

In recent years, we have modified our production practices to be even more selective of our seed sources and to cull plants based on fall color performance. For instance, seed is picked at the time of fall coloration so that we can identify the blocks with the highest percentages of orange-red colored plants. We review all the blocks in the nursery before proceeding to pick. Once we have the best blocks identified we pick from the most colorful individuals that have good seed (Fig. 3). Then we grow the seedlings in an outside seedbed for a year. We dig and grade the plants in late fall, saving the best grades for our field production. They are typically 6-12 in., 1-0 seedlings, though we do usually get a small percentage of 12-18 in. plants. Plants under 6 in. in height are culled.



Fig. 1. *Carpinus caroliniana* seedlings at Johnson's Nursery in 1984 – a few have red fall color.



Fig. 2. *Carpinus caroliniana* J.N. Strain at Johnson's Nursery in 2001 – improved percentage of individuals with red fall color.



Fig. 3. *Carpinus caroliniana* J.N. Strain at Johnson's Nursery in 2008 – continued improvement in percentage of individuals with red fall color.

The seedlings are lined out in transplant rows for a year. In autumn, they are evaluated for fall color and any non-orange-red, fall-colored plants are destroyed. They are dug, graded, root pruned, and bundled in the late fall. In spring the plants are lined out at one foot apart in rows 5 ft apart. Again, only the top of the grade is allowed to go to the field. These are grown in this location for 2 years. Most plants will grow to a 18-30 in. in height in this time frame. Again, any plants not colored orange-red in the fall are culled.

These liners are spring dug bareroot and lined out in rows 10 ft apart and the plants spaced 5 ft apart. In year 3 at this location, we expect to begin selling 4 to 5 ft, shrub

form, B&B plants from the block. The rest of the block should be mostly gone by the end of year 5 if the market is healthy.

### **Clonal Selection and Propagation**

Cultivar selection of *C. caroliniana* and their propagation is a relatively new endeavor in our industry. Few cultivars have been selected from this species and of those, most are not adaptable to Southern Wisconsin. The two most commonly available cultivars in commerce, 'WFS-KW6', Native Flame<sup>®</sup> and 'CCSQU', Palisades<sup>®</sup> musclewoods, have not proven to be reliably hardy in Wisconsin. I suspect they were selected from provenances much further south than Wisconsin. It was for this reason as well as the availability of large populations of seedlings to select from, that cultivars derived from northern seed provenances were selected at Johnson's Nursery. The two that have been released to date are: *C. caroliniana* 'J.N. Globe', Ball O' Fire<sup>™</sup> musclewood (Fig. 4) and *C. caroliniana* 'J.N. Upright', Firespire<sup>™</sup> musclewood and (Fig. 5). As can be inferred from the names of these *C. caroliniana* clones, they were selected for their unique forms and wonderful orange-red fall colors.



Fig. 4. *Carpinus caroliniana* 'J.N. Globe', Ball O' Fire<sup>™</sup> musclewood.



Fig. 5. *Carpinus caroliniana* 'J.N. Upright', Firespire™ musclewood.

Clonal propagation of *Carpinus caroliniana* has not been readily documented. The species is said to be able to be rooted from softwood cuttings but is difficult. I can attest to that as being true. Of the hundreds of cuttings that I have stuck at various times of the year over the last 25 years or so, I have one plant to show for it. I know of numerous nurseries in Oregon that produce *Carpinus caroliniana* clones by grafting in the winter with the use of a hot callus pipe. A tissue culture lab is working on the micro-propagation of *Carpinus caroliniana* but has not succeeded as yet.

#### **Grafting Process**

I would like to explain a grafting process that I am perfecting after working on it for the last 15 years or so. It is a method of side-veneer grafting cultivars of *Carpinus caroliniana* in summer in an unheated polyhouse under mist (Fig. 6).



Fig. 6. Newly completed graft.

The keys to success with this method are the timing of when the grafts are done, mid-summer, and the condition of the scion wood and understock. They must be very vigorous or success is unlikely. For understock, I pot 1-0 bareroot seedlings that are typically 6-12 in. tall with a caliper size of 1/8-3/16 in. They go into a #1 container. By summer grafting time, mid-July, these plants grow to become 1/4" to 5/16 in.-caliper plants, ideal for grafting. Scions are gathered from plants grafted in the previous three years. These young, vigorous growing plants will have current season's growing shoots from 18 to 30 in. in length with stem calipers up to 1/4 in. in diameter. The scions should be lignified at the base. If they are too green they rot readily.

The grafting itself is rather typical. I use a cut that is about one inch long and perfectly flat on one side with a wedge at the base in which to place the scion. I make the same matching cut on the scion and line the cambiums up on one side. When preparing the scion, I use a 6-in. stick from the bottom of the vigorous shoots described earlier. I leave 3 or 4 leaves on the scions and may cut some of the leaves in half if they are relatively big. The grafts are tied with a light-gauge budding rubber. The completed grafts are taken

to an unheated polyhouse covered with white 4-mil overwintering poly and 55% Saran shadecloth. They are placed straight up in a bed of sand with the pots and unions buried. The plants are pot to pot in rows that are 15 in. apart.

I make sure the pots are thoroughly watered before plunging them in the sand. The grafts are misted for 12 s about every 15 min on a typical sunny summer day. The house is rarely vented. Temperatures in the graft house can go to 110°F. Once it gets hotter than that I may vent the house by opening doors and increasing the mist frequency. About every 10 days I turn the mist on for about 4 h to thoroughly water the grafts. After about 7-8 weeks the grafts are healed and the mist is gradually cut back and the doors of the polyhouse are opened.

The plants are allowed to go into dormancy naturally outside before they are overwintered in an insulated unheated building for the winter. In late March, they are pulled from the building and placed in an outdoor growing area. Once new growth commences, they are cut-back and re-potted into larger containers for growing on. Depending on the variety grafted, they will typically grow to 3 to 4-ft tall plants the first season after grafting. I usually do little pruning because I want to save the vigorous wood for the next season's scions. I suspect if the plants were to be pruned earlier in the season taller plants could be developed in one season.

The grafted plants are upshifted to a #5 container at the beginning of the 2<sup>nd</sup> year after grafting. By the end of this growing season the *Carpinus* will typically be 4-6-ft branched plants.

My most recent cultivar selection work with *Carpinus caroliniana* has been focused on faster growing cultivars with orange-red fall color as well as fastigiate, spreading and pendulous forms. I hope the improvements that I have made in selecting superior cultivars of *C. caroliniana* and in gaining a better understanding of their propagation and production will make this species much more commercially viable than it has been in the past.