2008 Final Report

FNE 06-577 Utilizing ¾ American Chestnut Hybrids for Timber, Wildlife, and Nut Production.

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The goal of this project is to show that ¾ American Chestnut hybrids can be utilized by Northeast farmers as a replacement for the American Chestnut tree. Asian – American chestnut hybrids are crossed to partially blight resistant American trees to produce ¾ American hybrids that posses all the desirable traits of the American parent such as cold hardiness, vigor, upright growth and dependable nut production, but with the blight resistance of the Asian parent. These hybrid trees can be grown for timber, wildlife plantings and for nut production.

My technical advisors for this project are Dr. William L. MacDonald and Dr. Dennis Fulbright. Dr. MacDonald is a professor of plant pathology at West Virginia University and was a founding member of the American Chestnut Foundation. Dr. Fulbright is a professor of plant pathology at Michigan State University and is the editor of Nut Tree Culture in North America. Both men have been invaluable to this project. Dr. MacDonald has supplied guidance from everything from the project goal, to the methods to attain it. Dr. Fulbright has also supplied insight as well as pollen from some of his American sources.

My project started in 2006. It was at this time that parent trees were selected and controlled pollinations were done. Paper bags were placed over the female flowers just prior to trees shedding pollen. This insured that the flowers would receive pollen only from the trees I wanted to use as the male parent. The details of which parents were selected, and the pollination process is available through SARE on their website in my 2006 Annual Report. My initial planting was done in 2007 on property in Tucker County, WV owned by Canaan Valley Institute. This location proved to be very unsatisfactory for chestnuts. Tree loss was very heavy just 4 to 8 weeks after planting. A survey at the end of 2008 showed just one surviving tree out of 30 planted. All 10 native Americans died, and 1 of 20 hybrids survived. The surviving hybrid, an (American x Chinese) x American has actually done well considering the site conditions. Tree height at the end of 2008 is 27 inches. The soil in this planting consists of very heavy clay. I am surprised this tree grew as well as it did this past season. The American x Chinese hybrid parent, AC-8, is the parent of some of my better trees. The pollen parent, R5T1, is pollen

provided by Dr. Fulbright. It is a 2nd or 3rd generation American from seed irradiated by Dr. Al Deitz.

In June 2008, a second planting was done in Barbour County, WV utilizing a mixture of new seedlings and 2007 seedlings not used in the first planting. Results from this planting have been much better. Sixteen out of 20 hybrid trees survived at the end of the growing season for an 80% survival rate. The average height of all hybrids was 24.52 inches. This includes the 1 year old and 2 year old seedlings. Interestingly enough, the tallest hybrid was a 1 year old seedling that reached 40 inches. This was quite impressive. Most seedlings leaving the greenhouse are 15 – 20 inches tall with little subsequent growth the initial season while the plant becomes acclimated. The parents of this monster are AC-8 as the female parent, and the pollen parent being R1Sec28, another Fulbright irradiated American. Fourteen of the hybrids are ¾ Americans. One hybrid is 69% American, with the following parentage, American x [(Chinese X American) x (Japanese/American x Chinese)]. It is 28 inches in height and made good growth this season. The female parent in this cross, WV-1, is an American which shows good levels of blight resistance and has been a parent of most of my better first generation hybrids. In fact, WV-1 is the female parent of tree AC-8. Another hybrid in this project is 81% American, with the following parentage, [American x (Japanese x Japanese/American)] x American. This seedling is 30 inches in height and appears to be vigorous and healthy. The remaining 2 hybrids are open pollinated seedlings from the American, MacD. It shows good levels of blight resistance for an American. It is surrounded in the orchard by American x Japanese and American x Chinese hybrids. The probability that these seedlings are ¾ Americans is high. As the tree grows I can determine the parentage with a higher degree of accuracy by tree characteristics.

The native Americans have not fared as well as the hybrids. Three out of ten Americans survived for a 30% survival rate. This is lower than I normally achieve, but typical in that survival is lower than the hybrid groups. Americans tend to do better when offered some shading in the first few seasons to help with establishment. Average height for the 3 Americans is 19.3 inches. This is also typical. The Americans are usually slower to start, but make good gains after developing a good root system. One of the Americans in this study is a graft of one of my favorite trees, R1T1, onto the roots of a seedling. This type of graft is called a hypocotyl graft. The original tree, R1T1 died from phytophthora and I feel fortunate to have saved this tree with a graft. It had typical American form and growth. The rings on the stump showed that the tree was increasing in diameter at almost .7 inches a year. It was a light nut producer, but very heavy pollen producer. If this graft survives, it should provide a good model to compare the hybrids to.

I did not measure the stem diameter on the seedlings at this stage for the main reason that there is not a large discrepancy among 1 and 2 year old seedlings. Most 2 year old seedlings will have a diameter similar to a pencil, and 1 year old seedlings a little more than ½ of that.

There are 2 obvious problems that I will need to address before this project is concluded. They are blight resistance and propagation of the most promising trees. There are a few problems inherent to testing blight resistance on seedlings. One is that seedlings can exhibit juvenile resistance, thus giving false results. The second is that the stem is so small, blight can encircle the stem before the tree could feasibly mount a defense. The proper time to test for blight resistance is when the trees are 5 to 7 years old. The method I plan to use was developed by the late Dr. Russell Clapper, Associate pathologist with the U.S. Division of Forest Pathology. A leather punch is used to make a ¼ inch incision into the bark. A piece of blight inoculum is placed into the wound and covered with masking tape to prevent drying. The inoculations are made in June, and measured at 2 months, 4 months, 10 months, and 2 years. The area of the canker is obtained from the product of width times length. This gives a theoretical rectangle that is about 27% larger than the actual elipse of the canker. Since all cankers are measured in an identical manner, no error is introduced into the results. Dr. Clapper found that data taken at 10 months was most useful in showing the relative progress of infections. At this time, some cankers on resistant trees were beginning to heal at the lateral margins. Data from these measurements will be used to place the trees into blight reaction classes developed by the late Dr. Arthur Graves of the Connecticut Agricultural Experiment Station. Class I, very resistant – no growth of the blight fungus. Class II, resistant – only slight growth; later, complete healing, callus forming around the canker. Class III, somewhat susceptible – slow growth of the fungus; callus may be formed but may be invaded later. Class IV, susceptible – fairly rapid growth of fungus, no callus formed. Class V, very susceptible – very rapid growth of fungus, no callus formed.

The trees that I hope would be useful to Northeast farmers would be those that fall into resistant groups I and II. In addition to blight resistance, trees would also have to have made adequate growth and exhibit timber type growth. Nut production is not something that could be gauged until much later. Hybrids with orchard type growth and form will sometime begin bearing nuts at 4 or 5 years of age. My better timber type hybrids sometimes do not bear until 10 to 12 years.

Propagation of chestnut trees can be problematic. Propagation by seed is the simplest method for any tree species that comes true from seed. Hybrid seed does not bear true. Since ¼ of the genes in these trees will be of Chinese or Japanese origin, it stands to reason that some seedlings from open pollinated mating may show very oriental characteristics depending upon

how the genes segregate. It also stands to reason that open pollinated progeny may show no blight resistance at all if it contains only blight genes from the American parents. However, if the desire of the individual is to make a large timber planting, open pollinated seedlings from a seed orchard with the most promising parents, would still probably be the best method. A small percentage may have orchard qualities and eventually be overgrown. A small percentage would be blight susceptible and also eventually weeded out. The majority should exhibit the qualities desired to make good growth and form a closed canopy. If the goal of the farmer/rancher is to make a small planting for wildlife or nut production, then grafting is certainly feasible. With practice, it can be determined what makes a good rootstock for the hybrids. Grafting is still the cheapest and surest way to reproduce a clone of a chosen tree. Tissue culture has been done with chestnuts. The results are mixed, and the end product is expensive.

My past experience with hybrid chestnuts has shown that a blight resistant tree with the American qualities is achievable. Once the final data is in on growth, form and blight resistance, all results will be made available through the Cooperative Extension Service. They can choose to make this information available in print or CD format for people in their database. I will also send this information to American Nuseryman magazine and the Northern Nut Growers Association so that potential propagators of the best trees can be found. I plan to post this information on a website along with general chestnut culture such as orchard establishment, care, harvesting, nut storage, and pest control.

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