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From the Editor

A New Look for the Next 25 Years

This issue of *The Journal of The American Chestnut Foundation* begins with a memory about a chestnut farm. Mr. C. K. Sober was a farmer and a noted sharpshooter in the late 1800s. At the turn of the century, Sober changed his attention to creating a profitable chestnut farm, trying 'uncommon' grafting techniques which led to surprising results.

'Science and Natural History' takes readers to the remote mountains of China. In September of 2008, TACF sent a delegation of scientists to observe and document chestnut in parts of rural China where the three species of chestnut grow naturally. The team's international collaboration has led to a productive relationship which will help guide TACF's breeding program and give new understandings of the natural habitat and characteristics of wild chestnut.

Also in this section, Carolinas Chapter President Steve Barilovits reports on his first year experiment: Use of Phosphite Compounds for Managing *Phytophthora* Root Rot in American chestnut. Steve's research, while still in the first year, will be helpful for others experimenting on blight in the future. This experiment could provide some much needed insights into one of the American chestnut's worst enemies.

Find out what happened during 2007-2008 at Meadowview Research Farm with the informative Meadowview Notes. The report discusses the Farm's inventory, harvest, and conditions throughout the year and gives understandable tables for members to follow.

Lastly, check out TACF's Regional Science Coordinators Report detailing progress of TACF's regional network of state chapters in the 'From then to Now' section.

Chapters need helping-hands during these busy months and every person counts. As the summer moves forward, make sure to check TACF's new online calendar for all the upcoming events in your area.
Enjoy the season.

Go to: http://www.acf.org/calendar.php

Louis Bedor III

MEMORIES

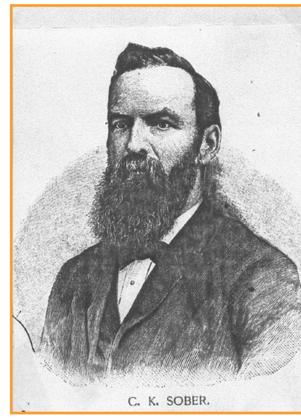
C.K. Sober's Chestnut Grove Stock Farm: A Native Chestnut Culture 'Paragon'

By William H. Sober Sr.

Transcribed and Edited by Louis Bedor III, TACF Publications Director

William H. Sober Sr. is an active member of the PA-TACF chapter and is the great-grandson of C.K. Sober, the main person in the story below.

In 1896 in Northumberland County, PA, C.K. Sober turned 400 acres of a wasted and unproductive piece of lumbered-off, mountainous terrain into permanent usefulness as a chestnut farm.



Picture taken in 1889 when C.K. Sober was 44 years old.

The steep ground surrounding Sober's childhood farm was loaded with wild chestnut. As a boy, he watched the landscape around his farm change as different areas of chestnut were cut down, only to be reborn again. Walking in the woods one day sometime after some chestnut trees were cut down, he noticed a luxurious second-growth appearing where a mighty chestnut tree once stood. Sober continued walking until he stood in front of one particular unusual-sized chestnut located at the edge of his farm. His thoughts drifted to the possibilities of grafting.

Sober learned how to graft from his father at age 18 while helping to graft apple trees. Grafting was found to be successful between nearly related plants such as: apple-quince, peach-plum, almond-apricot—therefore, the chestnut should graft successfully to oak or beech, so he thought. He took his father's teachings and applied them to chestnut, grafting scions upon other native trees. The shoots from the old chestnut stumps were allowed to grow until reaching 1 or 2 years-old and were then grafted to red oak and scarlet oak.

His idea was new and his father laughed at him and asked, "Who ever heard of grafting chestnuts?"

Sober remained undaunted as the years passed and he continued trying to perfect his method. Finally, in 1896, his dream of owning his own farm became a reality as he purchased his father's farm and renamed it *Chestnut Grove Stock Farm*, which was located in the beautiful Irish Valley, about seven miles from Shamokin, PA.

Sober's original 'Paragon' tree was grown in Germantown, PA by W. H. Shaffer, from a nut brought to this country from Europe. The nuts falling from the tree were of excellent quality and compared favorably in sweetness and flavor to the native chestnuts in the area, so Sober took some to his property and planted them. The nuts themselves were found to be between 3-4 inches in circumference while the occasional nut grew to a size where it would cover a silver dollar. When collected, approximately thirty-two nuts weighed one pound and forty-eight average nuts filled a one-quart measure. The nuts ripened in the last week of September or in the first week of October, and there were three to five nuts per bur. Most burs were of immense size, often reaching five inches in diameter or more, with spines reaching lengths of one inch or more.

Most of the 'Paragon' scions were grafted on red oak sprouts, but the sprouts were not free from insects. Amazingly enough, the 'Paragon' sprouts seemed to be less affected by the weevil than other varieties of nuts, but the grafts were not attaching well.

Sober supervising chestnut grafting.

In 1898, Sober began using professional grafters and the forthcoming results were discouraging: less than 5% of the scions grafted lived. The imperfect wedge grafts they applied allowed only a small number to grow. The rapid growth of the scion, made possible by the stock's good root system, was too much for the young shoots. The weight of the leaves made them top-heavy and the grafts would fall apart with the lightest wind.

In 1899, Sober continued his experiments on grafting and, finally, devised methods to reduce failures by grafting on chestnut. Beginning in February and March, Sober collected his scions and stored them in an ice-house, packed in damp sand or moss and surrounded by ice cakes. Once grafting season started in May, Sober hired some 15-20 extra workers and out-planted his grafted scions, using the whip or tongue graft technique. The grafting material Sober used was common resin, bees wax, beef tallow, and strips of muslin cut to a desired size and length and wrapped around the callus (the union between the stock and the graft) to protect it during growth. Then, all summer long, Sober and his team kept the grounds around the grafted trees clean by mowing by sheep or burning. With these new methods, 75% of the scions grafted in 1900 lived.

From then on, most of the grafting was done in the spring. The chestnut sprouts were left to grow one year before grafting was started. The second-year graft survivors were cut back to assure a good top and replanted in an area where they could begin to fully develop. These trees grew rapidly and at age 2-3 years, they began bearing nuts. Trees only 4 years old were known to bear up to 300 burs.

After five years of growth, the best trees would be left standing and the others were used to furnish new scions. The sheep had a dual purpose: they kept the area clear around the grafts and they also provided liquid and solid manure for the farm to use. As trees got larger Sober added cattle to the pasture, making a total of 500 livestock on the property. Sober then rearranged his plantings to create his chestnut orchard, with trees planted 15-30 feet apart on cultivated land and, finally, fencing it all in, using over seven miles of wire.

Sober and his team hand-harvested the nuts using long wooden-poles to knock the burs from the tree. The burs were collected and transported to either a shed or an open patch of field to dry, allowing the bur to open. Finally, the nuts were either removed by hand or by the machine Sober built (pictured right). The nuts were sorted into bags and taken to market and sold for prices initially ranging from $5-$12 a bushel, due to the demand. Prices soon dropped to $2.50 per bushel, but that price was still more than a bushel of wheat.

Farm crew harvesting chestnuts.

At that time, it was said one acre of land will grow 35 bushels of wheat in one year. Sober's chestnut trees produced as many bushels, many times over in one year, and required no cultivation, replanting, or fertilization. The spring rains, the summer droughts, and the fall frosts made no injury on the trees or their fruit. Apparently, Sober was a very smart man indeed!

Chestnut Grove Stock Farm ran successfully as a thriving chestnut farm from 1896 until 1913, when the blight hit the area.

Additional Reading

Davis, N. F. (1904). *Chestnut Culture in Pennsylvania*. [Harrisburg]: W.S. Ray, State Printer of Pennsylvania.

Science and Natural History

The American Chestnut Foundation Expedition to China

By Dr. Kim Steiner, Dr. Fred Paillet, Dr. Fred Hebard, Dr. Songlin Fei, and Sara Fitzsimmons

Summary

A delegation of five researchers travelled and documented wild chestnut trees in two regions of Hubei and Shaanxi Provinces in China. All three native chestnut species were observed, though *Castanea henryi* (the mountain chestnut) tended to be most prevalent and only a handful of *Castanea seguinii* (the seguin chestnut) were documented. Many *Castanea mollissima* (the Chinese chestnut) were encountered, though a great majority appeared to be the product of direct planting or naturalization (escape from cultivation).

In most areas visited, one or all of those chestnut species were dominant or co-dominant in the forest canopy. *C. henryi* tended to have the most classic timber form and growth of the three species though *C. seguinii* was observed reaching heights almost to 90 feet and girth to 25 inches diameter at breast height (dbh, 4.5 feet from the ground). *Castanea mollissima* was found at only moderate sizes and had the smallest average size of the three species.

Chestnut blight was found at each location on all three species, although severity was slight. Blight was least severe on *C. henryi*, followed by *C. seguinii*, with *C. mollissima* having the highest severity of the three species. However, only one recorded instance of stroma, the fruiting bodies of the fungus, was observed in conformance with the hypothesis that all three species have high levels of resistance to the disease. Fungal identification was confirmed by isolations of the blight fungus performed by Dr. Wei He at Beijing Forestry University.

Introduction

Although the mission of The American Chestnut Foundation (TACF) involves a breeding program based on the incorporation of Chinese chestnut genes for blight resistance in American chestnut, relatively little attention has been paid to the nature of the blight in its homeland or the ecology of Chinese chestnut in the wild. This obviously stems from the great distances involved, as well as the obstacles facing collaboration among scientists from such different academic and political cultures. Sponsored by TACF, Penn State University, and in large part by the United States' Department of Agriculture's Foreign

Figure 1:. Travel path of research group through China. Map courtesy Dr. Songlin Fei.

Agriculture Services Scientific Cooperative Exchange Program (USDA FAS SCEP), a team from TACF undertook an expedition in September 2008 to Hubei and Shaanxi Provinces (Figure 1) to address various questions about chestnut and blight in the Far East which have arisen over the years.

While there, our group hoped to learn how well the three native chestnut trees of China thrive in the wild in the presence of the native chestnut blight fungus (*Cryphonectria parasitica*). In effect, we wanted to observe how the native species fare against the native disease with the resistance level that we are striving for in the American chestnut breeding program. We also wanted to observe the ecological roles served by each of the three native species as well as the role served by the fungal species and any other pests or pathogens which might be discovered. Some small amount of research has looked at the relative resistance of Chinese chestnut cultivars to various strains of the chestnut blight pathogen (Ling et al., 2002), but little to no published material is available on similar studies performed on wild type trees or observations of interactions in the wild.

But we had many more questions. What are the ecological roles of the Asian chestnuts in wild forests? Are there timber-type Chinese chestnuts, or are they "orchard" trees even in the wild? How attractive are the other two species as sources of resistance to the blight? What are they like in the wild? How do the Chinese regard the blight, as a forest pathogen?

With those general objectives and questions in mind, our mission had one over riding goal: to develop relationships with chestnut scientists in China as the basis for future collaboration. A single two-week visit could not possibly serve to answer all of our questions. We hoped that our interest and enthusiasm would engender cooperative research activities that would pay dividends in the years to come.

We arrived in Beijing individually over a period of several days around the 10th of September. Our team included Kim Steiner (Penn State University), Fred Hebard (TACF), Songlin Fei (University of KY), Sara Fitzsimmons (TACF), and Fred Paillet (University of AR). Kim's wife Susie and Ms. Yan Xu, an Agriculture Ministry coordinator from

Beijing, rounded out the team (Figure 2). Two professors from Beijing accompanied us on much of our tour: Dr. Zehao Shen, from Peking University, and Dr. Wei He, from Beijing Forestry University. We subsequently met other local foresters and scientists at the two preserves we visited during our stay.

What kind of chestnut trees did we see on our visit? The native *Castanea* trees in China comprise three species: *C. mollissima* (Chinese chestnut), *C. henryi* (Chinese chinquapin or mountain chestnut), and *C. seguinii* (seguin chestnut). The first of these is the familiar orchard tree that produces the nuts we see on the market in this country. Mountain chestnut has a relatively restricted range in the south central part of the country, and was the chestnut species we saw most often in the wild (Figure 3.1 and 3.2). The nuts are always borne singly in a relatively small bur, so the chinquapin designation alludes to the small size of the nut rather than the stature of the tree. Seguin chestnut has a somewhat more northerly range, but was assumed to be a relatively small tree based upon published descriptions. We expected to see all three species inhabiting the same forests in the mountains just north of the Yangtze River, and hoped to see Chinese chestnut growing in natural environments at locations further north.

During repeated site visits we found that distinguishing these three species was not always easy. Photographs of Fred Hebard

Figure 2: Group photo taken upon arrival at Dalaoling National Forest Park. Pictures from left to right are: Mr. Daoxing Li, Dr. Zehao Shen, Ms. Yan Xu, Dr. Kim Steiner, Mrs. Susie Steiner, Dr. Fred Paillet, Dr. Fred Hebard, Dr. Songlin Fei, Ms. Sara Fitzsimmons, Dr. Wei He, Mr. Shen-Dong Xu, and Mr. Qingyu Han.

*Figure 3.1: Sketches of mountain chestnut (*Castanea henryi*) at Dalaoling Preserve: A) Typical tree about 16 inches dbh and 75 feet tall, corresponding to the average size of chestnut trees on Professor Zehao's 5-acre study plot; B) Base of tree showing typical root collar without buds, burls, or basal sprouts; C) Sun leaves from fallen branch; D) Burs and nut on one of many twigs cut from canopy by squirrels who were attracted to the ripening nuts; and E) An older seedling showing several cycles of dieback and stem regeneration.*
Sketches by Fred Paillet.

huddling with a magnifying glass and handfuls of chestnut leaves became symbolic of our trip (Figure 4). The criteria we finally agreed were diagnostic of the three species are shown schematically in Figure 5. We also sampled the wares of street vendors selling roasted chestnuts in towns along the way (Figure 6). These were generally of two types: the larger chestnuts called "ban-li" (Chinese chestnut) and smaller, acorn sized nuts they called "mao-li" (sequin chestnut).

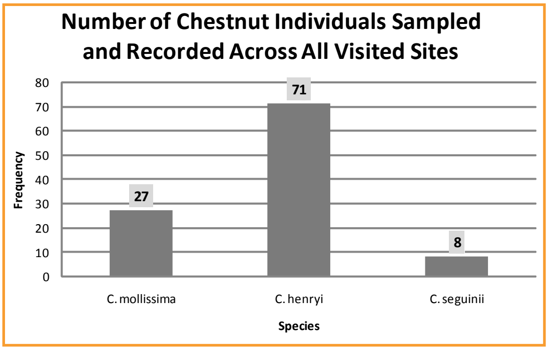


Figure 3.2: Frequency of chestnuts sampled among all sites visited.

Figure 4: An oft-repeated scene: Dr. Fred Hebard carefully studies a chestnut leaf sample with a hand lens, working to determine species identification.

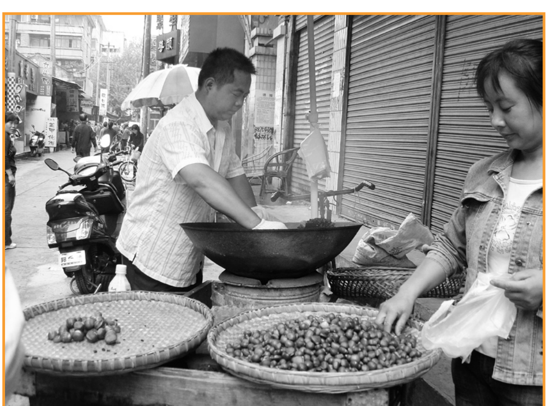


Figure 6: Street vendors with roasted chestnuts.

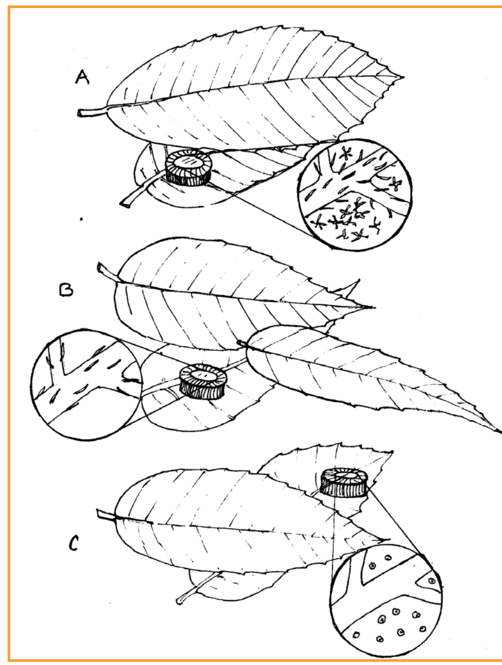


Figure 5: Identification of chestnut species by leaf shape and presence of hair and/or glandular hairs on the underside. A. Castanea mollissima*—leaves broadest towards the tip and generally with prominent teeth; dense hairs on veins and stellate hairs on the underside between veins. B.* Castanea henryi*—leaves broadest near the base but quite variable in shape and tending to become long and narrow near the tips of long shoots; sparse hair on veins and no stellate hairs. C.* Castanea seguinii*—leaves generally oval with widest part at or slightly beyond the midpoint; only glandular (mushroom-shaped) hairs on the underside between veins. Sketches by Fred Paillet*

Distinguishing the three species in dense forest under misty, late-monsoon conditions was a continuing challenge throughout our visit.

Figure 7: Mountain scenery in Shaanxi province.

Stop 1: Dalaoling National Forest Preserve

After an overnight in Beijing, the team immediately departed by air for the town of Yichang located on the Yangtze River in Hubei Province a short distance below the famed Three Gorges Dam. Next morning our bus began a slow ascent into rugged mountains through impossibly steep countryside under dense cultivation—with a short stop for views of the gorge and dam. The intensity of cultivation was truly amazing. Tall corn plants with giant ears were used as support structures for beans and squash, and alternated with rows of peppers and various vegetables. As we drove ever higher, rows of tea were interspersed with the other crops. It appeared that not one square foot of soil went to waste, and everything that was not too steep to stand up on seemed to be cultivated, even the shoulders of rural roads. Elaborate stone work in the form of gutters and retaining walls served as further testimony to the industriousness of local residents. The landscape could be described as granitic karst, where intense weathering in a humid climate has deeply weathered bedrock by chemical dissolution of silica. Thus, the steep mountains had the conical "haystack" look so often seen in Chinese artwork even though the substrate was not limestone (Figure 7). As we climbed, the steepest and highest ridges began to develop a cloak of dense scrub and then small groves of trees started appearing in protected hollows.

Our bus pulled into the entrance to Dalaoling National Forest Preserve at about 5,000 feet in elevation. We were met there by Preserve Director Shen-Dong Xu and his staff. Our orientation included a tour of the local herbarium and an introduction to the geography of the park, which covers a broad, high ridge where about 50% of the cover was planted larch and pine, and the rest remains in native hardwood forest. We settled into our accommodations and prepared for the adventure to begin.

After lunch, our bus took us to the end of the road in the park amid some of the wildest scenery available in this densely-populated country. We began a walk down a rough forest road alongside a sparkling clear brook under a dense deciduous forest of magnolia, oak, dogwood, birch and beech. The understory was filled with ferns and such familiar shrubs as hazel, hydrangea, sumac and witch-hazel. It was as if the Appalachian forester had somehow entered a parallel universe. Kiwi fruit vines and other lianas entwined the lower branches of trees. Wildflowers such as blue harebells, yellow jewelweed, and pink anemones sparkled from the roadside. The air was alive with the sounds of tree frogs and chirping insects. Then our ultimate objective, chestnut, began to appear in abundance. These trees varied from 10 to 18 inches in diameter and from 45 to 90 feet in height. Many showed damaged crowns attributed to the "ice storm of the century," which had devastated forests throughout central China the previous spring.

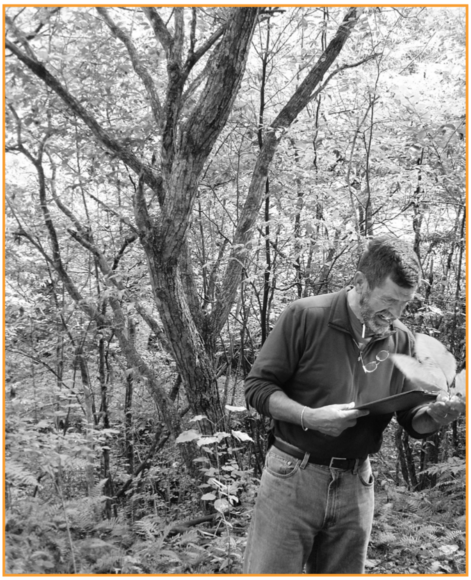


Figure 8: Fred Paillet stands in front of a Chinese chestnut, with the typical form of what appeared to be naturalized trees of that species around Dalaoling National Forest Preserve.

Our first problem was just getting to the chestnut. The rough road was carved into the side of a steep hill, making off-road excursions a real challenge. With difficulty we managed to roam up and down a short distance, finding chestnut to compose about 50% of the forest on these steep slopes, in the company of oak (*Quercus aliana*) and a planted 5-needle pine (*Pinus armandii*).

But exactly what species of chestnut were these? Our final conclusion with the help of our colleagues was that all three were present, but mountain chestnut clearly predominated. All three species seemed to be about the same stature, except that Chinese chestnut almost always had a rather poor growth form with multiple stems and crooked branches (Figure 8). The others grew mostly as straight and tall trees, and mostly with single upright stems. None of the trees showed the presence of basal shoots from dormant root-collar buds except for a few obviously injured trees—a real contrast to wild American trees in Wisconsin's naturalized West Salem stand or wild European trees in the Caucasus (Pridnya et al., 1996).

The understory of the forest was full of shrubs, but relatively little of what foresters call advance regeneration. Such understory progeny of canopy trees are considered to be the critical element in the regeneration of oak-dominated forests in North America. We did see a sporadic distribution of oak and chestnut seedlings, and saplings of both species were part of the exuberant growth in the small openings along the road. There were abundant burs in the crowns of chestnut trees and many on the ground where squirrels had been cutting them down and chewing on the green fruit. In contrast, the oaks appeared to have hardly any acorns at all. Almost all of the fallen burs were characteristic of the mountain chestnut—relatively small and each containing a single chinquapin-sized nut or nut cavity. A small crowd of students, park staff and local foresters followed us on our inspection, as we delighted one another with our interest in the forest in general and chestnut in particular–providing proof that enthusiasm for chestnut knows no barriers in either language or culture.

Figure 9: Kim Steiner measures a large, timber-type specimen of mountain chestnut.

Our second and third days at Dalaoling were devoted to more serious study of the chestnut stand. We devised a systematic way of scoring trees for form, vigor and extent of blight, supplemented by standard measurements of height and diameter. A pattern began to emerge over time. Mountain chestnut (Figure 9) was itself more abundant than either of the other two species. Seguin chestnut was often just as large as mountain chestnut and it had the same upright, timber-tree form. In contrast, Chinese chestnut was relatively uncommon and of low stature with multiple low branches. Of course, there was no part of the forest which could be considered free of disturbance, so these could be orchard trees that have escaped back into the wild.

Figure 10: Photograph of blight on mountain chestnut at Dalaoling Preserve.

One of the more interesting observations was that many of the Chinese chestnut trees showed signs of blight. Several had blight-like cankers, crown die-back, water sprouts from the vicinity of the canker, and basal sprouts stimulated by the injury.

On the second day, a pair of inch-diameter sprouts from the base of what had been a large tree were definitely seen to have the characteristic orange fruiting bodies filling the crevices in well-developed cankers, confirming blight on *C. mollissima* (figure 10). We saw no such incidence of active blight on the other two species. We did sample a number of minor rough spots on the bark of mountain chestnut that could have been indicators of very minor blight. At least a couple of these later appeared to generate blight in cultures in the lab. Our Chinese colleagues were emphatic in confirming the conclusion. To their knowledge, Chinese chestnut is generally more susceptible to blight than the other two species.

Another important part of our visit to Dalaoling was the opportunity to inspect Professor Zehao Shen's 5-acre study plot in a high saddle in the remotest part of the preserve. This required an adventuresome trek up the center of a steep and slippery ravine in the rain and fog, groping our way around waterfalls and mud-filled basins. We passed beneath large beech and black birch trees as well as oak and chestnut. The edge of the test plot coincided with the entrance to a cove-like bowl at the head of the drainage. Every stem on the plot greater than about an inch had been carefully marked and tallied[1]. Mountain chestnut was the leading dominant with about 20% of total stand basal area. The other two chestnut species (not differentiated in the data set) comprised about the same proportion, with oak slightly less. A few other genera (beech, birch, magnolia, and poplar) added at most a few percent each. The remainder was scattered among a diverse list of species such as dogwood, maple, cherry, linden and mountain-ash.

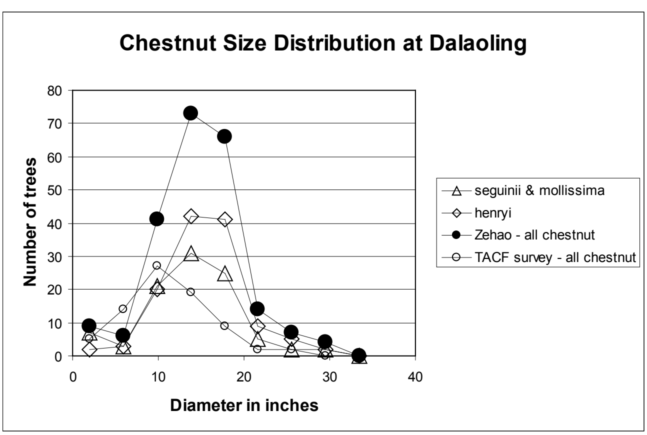


Figure 11: Diameter distribution of chestnut trees on Dr. Zehao Shen's test plots suggests an even-aged stand averaging about 16 inches in diameter. Data for chart provided courtesy of Dr. Zehao Shen.

The statistics on the chestnut on this plot matched almost exactly those of our own less rigorous tally. In both cases, the size distribution indicated a single-aged stand with an average diameter of about 16 inches (Figure 11). The ability of mountain chestnut to grow to more substantial size was indicated by a pair of old saw-cut stumps larger than two feet in diameter left over from selective cutting before the preserve was

[1] Many thanks to Dr. Zehao Shen for sharing his data on the site with our group.

created. Some anecdotal observations were also impressive, such as a ramrod straight seguin chestnut almost 18 inches in diameter and about 90 feet tall—a real timber tree in anyone's book! This observation, in direct contrast to published literature indicating that seguin chestnut is only a small, shrubby tree (Sargent, 1917 and Wu and Raven, 2003), is one which should lead to a good deal of further investigation.

Stop 2: The Ankang Region, including Nan Gongshan National Park

After our short three days at Dalaoling, it was time to move on to another forest district. Along the way we visited a few local forestry sites, including two logging operations and a site where abandoned farmland was being converted to chestnut woodland. The logging operations were a firewood harvest and a thinning to release a pine plantation being overtopped by a mixture of mountain and Chinese chestnut. In both cases these were chestnut and oak of modest size—less than a foot in diameter and less than 50 years of age by actual ring counts on the stumps. Chestnut trees seemed to have reasonably good form and vigor, but mountain chestnut largely predominated.

Figure 12: Group picture at Chinese chestnut orchard outside of Ankang. Pictured from left to right are: Dr. Kim Steiner, Mr. Cao, Ms. Sara Fitzsimmons, Dr. Fred Paillet, Dr. Fred Hebard, Mr. Yu-Zhao Chen, and Dr. Zhoumin Lu.

Near the city of Ankang we toured a region of abandoned farmland where the reason for abandonment was rather obvious. Local forestry representatives, including Mr. Yu-Zhao Chen, Director of Forest Regeneration, and Dr. Zhoumin Lu, Northwest Agriculture and Forestry University, accompanied us on this leg of the trip (Figure 12). The steep and gullied hillsides had only the slightest residual cover of poor stony soil developed out of a low-grade metamorphic rock. The local foresters explained that the land was being planted in chestnut to inhibit erosion while providing a seasonal cash crop for the local residents. Indeed, we saw several older women collecting the ripening chestnuts on the ground as we inspected the stand. These were all Chinese chestnut trees with an occasional Japanese chestnut. Blight was present on some of the trees in the form of large ugly cankers that disfigured and distorted major branches without actually proving lethal. Although chestnut blight seemed to be the primary cause of the disease, a combination of other fungal and insect pests seemed to be taking advantage of the wound after it was established. The trees in this extensive plantation were far from wild but provided yet more evidence that the blight can be quite problematic on *C. mollissima* in its native range.

Our second visit to a relatively pristine chestnut area was at the Nan Gongshan National Park south of Ankang in Shaanxi Province. This required another lengthy excursion through the Chinese countryside following rivers and then mountain streams ever upward to the preserve. As in many parts of China, the preserve surrounds an ancient Buddhist temple on the summit of a high ridge. The sacred nature of the site helps preserve the integrity of the wooded landscape. In this case we could not examine the forest at the summit because a dense fog shrouded it all. Our recourse was to drop back below the cloud deck and examine chestnut along the roadside. Truly heroic levels of mountainside scrambling were required to measure these trees. Songlin Fei and Fred Hebard may hail from different sides of the globe, but they both demonstrated a bit of mountain goat in their ancestry. There were wonderful vistas of leafy deciduous slopes across the way, with the golden yellow of ripening rice in the fields below.

The overall results of our survey were otherwise similar to our results at Dalaoling. One of the major differences is the certainty we developed that the Chinese chestnuts at Nan Gongshan were of wild origin and not naturalized or planted. Chestnut was the leading component in the diverse, deciduous forest of the park, with oak largely next in abundance. Mountain chestnut predominated but Chinese chestnut was common. We were told of very large and wild-grown Chinese chestnut in the region, but the locations were vague and, in any event, inaccessible to us during this trip.

Wrapping Up The Trip

The last leg of our field trip was a long drive north to Xi'an, the historic capital of five important dynasties in Chinese history. We had hoped to see the scenery in the Qinling Mountains, but an extended road closure to clear an accident forced us to travel late. As the light faded we could see abundant chestnut mixed with pine and oak on the surrounding hillsides, but the rest of the trip was in darkness. The only interesting sight was a glimpse of a panda crossing sign near the summit of the range. While in the area we could not miss viewing the famous terra cotta army of Qin Shihuandi. We also enjoyed the adventure of riding four at a time in a motorcycle rickshaw. Then it was time for our return flight to Beijing and meetings with our academic counterparts at the university.

At Beijing Forestry University we saw dramatic photographs of the ice storm damage and

Figure 13: Group photo on the Great Wall.

a nice display of Chinese forest tree diseases in the lab of Prof. Wei He, a forest pathologist. We also saw the results of cultures derived from possible cankers we had sampled at Dalaoling. Several of these certainly looked like chestnut blight. We then gave a well-attended seminar on American chestnut and TACF's breeding program to faculty and students at Peking University. Afterwards, there was a formal reception and pleasant dinner at a local hotel hosted by Dr. Jing-Yun Fang, Professor of Plant Ecology and Chairman of the Department of Urban and Environmental Science at the university. Of course, we managed short tours of the Forbidden City and the Great Wall along the way (Figure 13). All of us were impressed with the ancient junipers and lacebark pines in the elaborate gardens within the imperial residence compound. We also had the chance to have dinner with Bruce Levine, a chestnut enthusiast working at the U.S. Embassy and formerly active with the TACF Maryland Chapter. We reluctantly departed with a better knowledge of chestnut and its environment in Asia, and the beginnings of what we expect to be an ongoing and productive relationship with Chinese chestnut scholars.

Future Objectives

Several months have now passed since our trip to China and the group is eager to continue work on initiatives originating with the initial exchange. Based on follow-up meetings and conference calls, the group has identified three major areas on which to focus in the upcoming year.

First, we'll look to initiate an exchange of genetic materials. Additional germplasm from China may offer novel sources of disease resistance and perhaps other characteristics that would be useful in our breeding program. Because of its size and timber-type form, and because we saw no serious blight on it, *Castanea henryi* seems to offer great potential for incorporation into the breeding program. Questions still surround its cold hardiness in the United States, but the only way to evaluate that will be through importation of material.

Though we will look to collect specimens of all three species from China, there is also interest in planting various sources of American chestnuts and TACF backcross material in

China. Our hosts were interested in planting this material not only for botanical demonstration plantings, but also as a chance to test TACF material for durability of resistance. Straight American chestnuts will certainly succumb to the blight fungus early on, but they can act as "trap trees" and allow the survey and observation of blight diversity of the native pathogen population.

A second area of research will be to perform a forest history analysis and reconstruction at Dr. Zehao Shen's "bench" plot in Dalaoling. Such a project would be analogous to work at Joyce Kilmer Memorial Forest. The overall goal would be to use dendrochronological analysis to reconstruct the response of chestnut to past disturbances and other events. Some trees at Dr. Shen's plot are upwards of 150 years old. Once baseline data are established, comparisons could be made to stands in other areas with histories of more or less disturbance. Also of interest would be the overall distribution of chestnut within the site with the potential of teasing out factors that contribute to that distribution.

The third area of focus will be observation and analysis of the blight fungus in China. Much is still unknown about how resistance to chestnut blight works. Further observation of patterns in resistance and susceptibility to the blight in wild populations of all three native chestnuts and of the influence of climate and habitat on susceptibility could inform our understanding of how those trees persevere in the face of a highly virulent pathogen. We expect that this knowledge will further our understanding of the ultimate amount of resistance that will be necessary (or achievable) in the restoration of American chestnut to its original range in the eastern United States.

Besides looking at populations of trees with regard to their resistance to the pathogen, further work could be done to simply describe and document the status of the fungal population itself. With the help of Dr. Wei He at Beijing Forestry University, the group would like to collaborate on a project to observe and analyze several traits of *Cryphonectria parasitica* populations in China. How much hypovirulence occurs in these native populations? How large is the range of diversity in overall pathogenicity? Can we quantify the diversity of vegetative compatibility (VC) types? Research and reasoning would suggest a high diversity of VC types, but current published studies were performed primarily in orchard locations, not in the wild (Liu and Milgroom, 2007).

Thankfully, there is still much to learn from future trips back to China. And the opportunity for extended backpacking excursions to follow up on rumors of 6-foot dbh *Castanea mollissima* in the remote "hollers" of Shaanxi Province seems very enticing!

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First Year Results on the Use of Phosphite Compounds for Managing *Phytophthora* Root Rot in American Chestnut Seedlings

By Stephen Barilovits III, President CC-TACF, Charlotte, NC

Author's Note:

The results given here are from a single experiment based on observations over only one growing season. Conclusions from the experimental data or observations should be regarded as highly preliminary.

Introduction

I was led to the work described in this article by two interwoven threads of causation. The first is that, as a new member of The American Chestnut Foundation, I was eager to plant pure American seedlings and watch their development near where I live in Charlotte. But over a period of three years, **every** healthy American chestnut seedling we transplanted from a pot into our local soil sickened and died within several months. These seedlings did not die from chestnut blight, but from something else that was even more deadly, which Joe James of Seneca, SC identified as "ink disease"—a root rot caused by the pathogen *Phytophthora cinnamomi*. Joe had previously run across the same problem in his chestnut plantings at the Chestnut Return Farm and had started work towards isolating families of *Phytophthora*-resistant hybrid chestnuts from The American Chestnut Foundation (TACF).

Research on pure American chestnuts indicates *Phytophthora cinnamomi* is close to 100% fatal to American chestnuts, and can be similarly fatal to blight-resistant hybrids unless selections for further backcross breeding are made for *Phytophthora* resistance as well (James, 2008). In the southeastern United States, many blight-resistant American chestnut hybrid plantings have failed because of the root rot disease caused by *Phytophthora cinnamomi* (Jeffers et al., 2007).

The second thread begins with a talk given by Gregory Miller of the Ohio Chapter at the 2007 annual meeting of The American Chestnut Foundation. Greg presented preliminary data indicating the phosphite-based Agri-Fos fungicide used with the organosilicate surfactant Pentra-Bark in trunk bark wetting applications was effective in controlling advanced chestnut blight caused by the fungus *Cryphonectria parasitica* in American chestnut. Prior to this report, no other fungicide treatments have been documented to be effective in systemically controlling chestnut blight in American chestnut.

Surveys of the literature on phosphite-based fungicides show these compounds have been used extensively for controlling a variety of *Phytophthora* and fungal diseases. This is particularly true in Australasia, where *Phytophthora* organisms have devastated both natural ecosystems and large agricultural plantings (Giblin et al., 2005).

The purpose of the experiment described in this article was to determine which applications of commonly available phosphite-based compounds might be effective in controlling infestations of *Phytophthora cinnamomi* in pure American chestnut seedling plantings (and by extension, in hybrid plantings). In parallel with this experiment, several wild American chestnuts infected with *Cryphonectria parasitica* were treated with phosphite-based trunk bark wetting solutions to obtain further estimates of their effectiveness in controlling chestnut bark blight.

The preliminary results of this work show foliar applications of phosphite compounds might be very effective in managing *Phytophthora cinnamomi* infestations in American chestnut seedlings. Positive results in the management of *Cryphonectria parasitica* (as reported by Greg Miller) and *Phytophthora cinnamomi* in American chestnuts through the use of phosphite-based compounds may result in development of effective, inexpensive, systemic treatments to control both diseases in orchards, or specimen plantings, of non-resistant pure or hybrid American chestnut trees allowing American chestnuts to be grown in managed plantings until maturity.

Phytophthora and *Phytophthora cinnamomi*

Phytophthora (from Greek, phyto – plant, and phthora – destroyer) is a genus of oomycetes, which also includes water molds, white rusts, and downy mildews. Early morphological studies identified these organisms as fungi, but more recent work, and molecular systematics, has confirmed oomycetes are not closely related to the fungi. The cell walls of fungi consist primarily of the polysaccharide chitin, which is also a key component of the exoskeletons of insects. In contrast, oomycete cell walls are composed of cellulose. The similarity in the ecological behavior of oomycetes and fungi is a classic example of convergent evolution. *Phytophthora infestans* was the pathogen causing the potato blight which resulted in the Great Irish Famine (1845-1859) that killed more than a million people (Campbell and Reece, 2005). *Phytophthora ramorum* is a recently identified pathogen responsible for the devastating Sudden Oak Death, which is currently affecting forests on west coast of North America (Rizzo and Garbelotto, 2003).

Phytophthora cinnamomi now has a worldwide distribution, but is believed to have originated in Papua, New Guinea. It received its name because it was first isolated from cinnamon trees in Sumatra in 1922. *Phytophthora cinnamomi* causes disease symptoms such as the rotting of fine and fibrous roots, and the formation of cankers and lesions on root collars, trunks and stems that can lead to crown-death. Because it affects a wide range of commercially important plant species, *Phytophthora cinnamomi* continues to cause large economic losses in agriculture, horticulture and forestry. It is considered to be a major threat to biodiversity within natural ecosystems (Hardham, 2005).

The historical effect of *Phytophthora cinnamomi* on the American chestnut is succinctly described by Sandra Anagostakis (Anagostakis, 2001):

> *"The first imported pathogen of chestnut for which we have records is a Phytophthora root rot. Corsa (Corsa, 1896) reported in 1896 that there was a marked decline of vigor of C. dentata through a broad area of territory in the southern United States. He said that up to 1825 there was no mention of the problem, but then trees started dying, beginning at the southern limit of the range, and by the time of his writing the destruction was nearly complete. George Clinton (Clinton, 1912), writing in the Connecticut Agricultural Experiment Station in 1912, quoted Mr. Jones of Riceboro, Georgia, on another native Castanea:*
>
> *'In the year 1825, during the months from June to September, I observed this tree [Allegheny chinquapin] dying when in full leaf, and with fruit half matured. I examined numerous individuals, and could find no internal cause for their dying. I at first attributed it to the great fall of rain which took place in the year 1823. During the month of July of that year a considerable quantity of land not subject to overflow was covered with water for some time, and the highest lands were completely saturated. The latter part of 1824 was very rainy … if the disease is not arrested, in a few years I fear it will be entirely exterminated.'*
>
> *"This disease is caused by an organism, Phytophthora cinnamomi" … "It spreads with the flow of water through the soil" … "On the roots and stems of chestnut infection results in an inky-blue exudate from the brownish-black lesion. The lesions girdle the roots and root collar, killing the tree. The problem was finally thoroughly studied by Crandall (Crandall et al., 1945) …in 1945 who identified the pathogen."*

The Carolinas Chapter of The American Chestnut Foundation (CC-TACF) has lost several breeding orchards due to *Phytophthora cinnamomi* infestation. Our experience confirms many lower and moderate elevation sites outside of rocky monadnocks and sandy ridges in the southeastern United States are likely to harbor *Phytophthora cinnamomi*. Speculation also exists that many lower elevation sites as far north as Pennsylvania are also susceptible to the same infestation. Recent geo-genetic-taxonomic work by Joey Shaw provides evidence that the southeastern United States contains the most genetic diversity within Castanea species in North America, which provides us with strong motivations to preserve more of the genotypes available in the southeast (Shaw, 2009).

Phosphite Compounds

Scores of papers on the use of phosphite compounds for the control of fungal and *Phytophthora* plant diseases have been published in the last quarter century. These compounds, also known as phosphonates, are salts or compounds of derivatives of phosphorous acid, $H_2(HPO_3)$. We used three distinctly different commercially available phosphite compounds in this experiment. Aliette, first manufactured by Rhone-Poulenc and now by Bayer Environmental Science, is largely aluminum tris[ethylphosphonate], $Al(CH_3CH_2(HPO_3))_3$, and is also known as aluminum ethyl phosphonate or fosetyl-Al. Agri-Fos, manufactured by Agrichem Manufacturing Industries of Loganholme, Queensland Australia, is a mixture of mono- and di-potassium phosphites, $KH(HPO_3)$ and $K_2(HPO_3)$. Prudent-44, patented (pending) and distributed by Lidochem of Hazlet, New Jersey, contains urea phosphite, $((NH_2)_2CO)(H_2(HPO_3))$, from a mixture of urea and phosphorous acid. Aliette and Agri-Fos are licensed and sold as systemic fungicides, while Prudent-44 is licensed and sold as a nitrogen (14-0-0) fertilizer.

Phosphites are distinct compounds from the phosphates, which are compounds derived from phosphoric acid, H_3PO_4. Phosphates occur in large natural deposits and are heavily used in agriculture as fertilizers. Phosphate ions and compounds are important components of all biological systems, and are components of DNA, phospholipids and species like ATP, which are vital to cellular energy metabolism.

The mechanisms by which phosphites work as systemic fungicides or phytophthoracides in plants are not yet fully known. Leon T. Lucas, presently Emeritus Professor with the Department of Plant Pathology at North Carolina State University, and others in his department ran simple experiments in the 1980s which indicated phosphites might not be direct phytophthoracides or fungicides. They did this by growing the pathogens on an agar substrate, and then applying dilute solutions of phosphite salts onto small areas of the growing pathogens. They found no real effect on the growth or survival of the pathogen on areas that had been directly treated with phosphites (Lucas, 2008). Similar early experiments showed no direct effect of phosphites on *Pythium* species (Sanders et al., 1983), lending to the hypothesis that phosphites stimulated a plant's natural defenses against disease. But other work shows phosphites do operate directly against the targeted pathogen (Fenn and Coffey, 1984). These two contradictory observations might

Figure 1: Picture of healthy American chestnut seedlings as experiment begins.

be reconciled by observations that higher concentrations of phosphate nutrients reduce the effectiveness of phosphites as fungicides (Grant et al., 1992). More recent work has shown that phosphites inhibit *Phytophthoras* directly by interfering with several enzymes involved with phosphate metabolism (Stehmann and Grant, 2000).

Allison McDonald, Bruce Grant, and William Plaxton did a research survey (McDonald et al., 2001) on the effects of phosphites on both plants and their pathogens and the use of phosphites in agriculture. McDonald reports phosphite ions are transported between plant tissues and are accumulated within plant cells. This helps to explain why phosphites are effective systemic fungicides, whether applied to leaves, bark, or roots. Understanding the Phosphonate Products (Landschoot and Cook, 2009) is a readable introduction to this topic and summarizes recent research results with an emphasis on the use of phosphites in turfgrasses. Both Landschoot and McDonald report work which has shown phosphite ions are slowly oxidized to phosphate ions by soil-borne bacteria. Phosphites have been claimed to be fertilizers as a source of phosphorous, but recent work has shown that phosphite ions instead work as an "anti-fertilizer" unless adequate amounts of phosphorous in the form of phosphate is available.

Materials and Methods

Experimental Setup: A total of 285 American chestnut (*Castanea dentata*) seeds were planted on March 29, 2008 in 95 twelve-inch diameter, 3 gallon pots, with three seeds per pot, at one experimental site in Charlotte, North Carolina. The pots were 80% filled with Fafard Special Mix, and the seeds were placed into the potting mix along central radii 120° apart and 3" from the side of the pots. Ninety pots were placed in a matrix of 15 rows by six columns on a raised platform about 8" above ground level. The other five pots were placed on a similar platform separated from the first by 30 feet. Both platforms were fenced to a height of 4 feet with plastic chicken wire, and very light-weight netting material was stretched and secured over the top of the fencing to form a squirrel proof cage for the planting. The planting site received about 60% of full sunlight due to the proximity of a grove of large white oaks. After planting, the pots were treated with a single application of Scotts Miracle-Gro All Purpose Plant Food fertilizer. During the 2008 growing season, the pots were watered on an as-needed basis (5 times in 2008) with city water.

Figure 2: American chestnut seedlings after Phytophthora cinnamomi *distress.*

Inoculation and Treatment

By June 27, 2008, the chestnuts had germinated and developed enough leaves to be able to treat them with foliar sprays of phosphites. All pots in the ninety-pot, 15 row matrix were inoculated with *Phytophthora cinnamomi*. Rows 1-4 were treated with Aliette; rows 5-8 with Agri-Fos; rows 9-12 with Prudent-44; and rows 13-15 were untreated. The pots in the separate 5-pot group were not inoculated with *Phytophthora cinnamomi*, and were not treated with phosphites. Figure 1 shows a photograph of the planting taken on July 1, 2008. Row 15 of the matrix is in the foreground, and row 1 in the background.

Water-based foliar sprays of the three phosphites were freshly prepared for each application in 24 oz quantities, which proved sufficient to wet all plant leaves just to the dripping point. The amounts of concentrated phosphite per 24 oz spray bottle were: Aliette, 1 teaspoon; Agri-Fos, 2 teaspoons; Prudent-44 2 teaspoons with 4 teaspoons of Nutral buffering solution. (These concentrations correspond to the recommended commercial dilutions: Aliette WDG, 7.5 lbs/100 gal; Agri-Fos 2 fl oz/gal; Prudent-44 2 fl oz/gal, with Nutral buffer at 4 fl oz/gal). During applications of the foliar sprays, all plants in rows outside those to be treated with a specific phosphite were covered with clean lightweight plastic sheets to prevent contaminating oversprays. The first of three phosphite treatments was applied on June 27. Only the Aliette-treated group showed any sign of phosphite phytotoxicity after spraying (a slight wilting of leaves) which disappeared within a day of treatment.

All of the pots in the ninety-pot, 15 row matrix were inoculated with one isolate of *Phytophthora cinnamomi* obtained from the Chestnut Return Farm in Seneca, SC. This isolate was grown on antibiotic impregnated potato-dextrose agar base infused with V-8 juice diluted to about a 5% concentration in Steve Jeffers' laboratory at Clemson University. The isolate was then adsorbed onto vermiculite that also had been previously soaked in the same dilute V-8 juice solution (James, 2009). On July 7, 2009, the treated vermiculite inoculum was introduced into the pots of the matrix. Three 1" deep radial furrows between the three plants in each pot were made and the vermiculite evenly distributed along the furrows. The furrows were covered and the pots flooded with water to spread the *Phytophthora* isolates throughout the pots. Following inoculation, phosphite foliar spraying treatments were repeated on July 28 and August 23, 2008.

Results

Within two weeks of inoculation, plants in the untreated rows began to show classic signs of *Phytophthora cinnamomi* distress–leaves drying, yellowing, turning brown, and dying on the plant. The photograph in Figure 2, taken on August 15, 2008 shows these symptoms in not only the untreated rows, but in some plants in the treated rows as well. One of the dead plants in the untreated rows was pulled out in August to examine its root system. The root system was missing or necrotic and the root collar blackened, all signs indicative of the *Phytophthora*-caused ink disease.

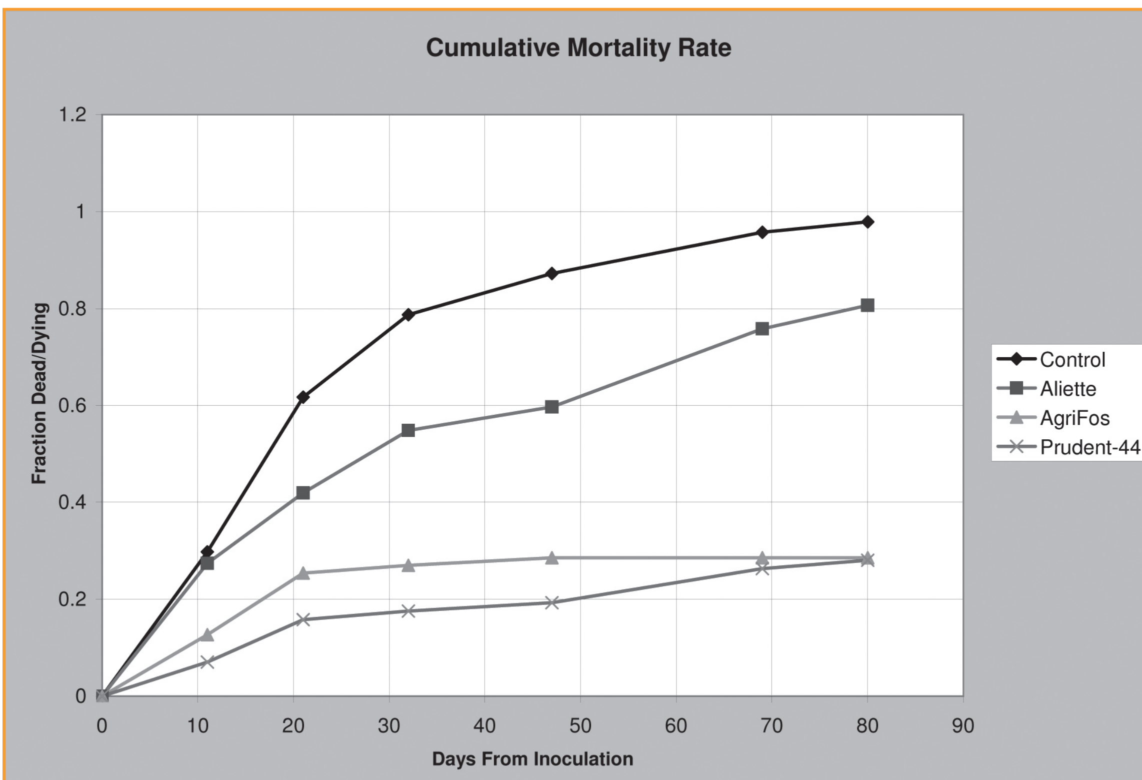

Figure 3

On July 18, July 28, August 8, August 23, September 14, and September 25, every plant in the matrix was examined for signs of *Phytophthora*-stress and the data was recorded. In no case did a plant recover from the stress—all plants first noted as stressed in one examination were dead in later examinations. Plants in the un-inoculated and untreated 5-pot group were also examined, and no germinated plants in the group showed any signs of stress, and none died during the 2008 growing season. Examinations were suspended by October, 2008, because normal fall leaf abscission made further determination of stress impractical. (Examinations will resume in the spring of 2009).

The overall germination rate for all plants in the experiment was 85%. The number of germinated plants within each group was: 62 in the Aliette-treated group; 63 in the AgriFos group; 57 in the Prudent-44 group; 47 in the inoculated but untreated ('control') group; and 13 in the un-inoculated group.

Figure 3 shows the cumulative plant mortality rates in the experimental matrix over time. Plants were counted as dead when they first showed signs of *Phytophthora* stress. Mortality rates were measured by the ratio of the number of plants alive with no stress signs divided by the number of plants germinated within the each of the treatment groups. The untreated group is denoted as "control" in the figure. Table 1 contains the data from which Figure 3 was created.

Table 1

Days after Inoculation	Control Mortality Rate	Aliette Mortality Rate	Agrifos Mortality Rate	Prudent-44 Mortality Rate
0	0.000	0.000	0.000	0.000
11	0.298	0.274	0.127	0.070
21	0.617	0.419	0.254	0.158
32	0.787	0.548	0.270	0.175
47	0.872	0.597	0.286	0.193
69	0.957	0.758	0.286	0.263
80	0.979	0.806	0.286	0.281

Cumulative American Chestnut Seedling Mortality Rate from *Phytophthora*, 2008

At every examination point, the mortality rates were always ordered: Prudent-44 group < Agri-Fos group < Aliette group < Untreated Group. By the last examination, the mortality ratios were: Prudent-44 group, 28.1%; Agri-Fos group, 28.6%; Aliette group, 81%; and the untreated group, 98% (one plant left alive). It is also interesting to note in the Agri-Fos group, no additional plant mortality was observed after the fourth examination on August 23.

Observations

The work described here was not a comprehensive multi-variable experiment designed to determine the best compound, application concentration, or application frequencies of phosphites to manage *Phytophthora cinnamomi* infestations in American chestnut. It was a simple, single year exploration in treating American chestnuts using phosphite compounds in concentrations and application frequencies suggested by a compound's commercial label for use on listed species, all unrelated to chestnut.

Under the conditions used in this experiment, the following observations were made:

(1) *Phytophthora cinnamomi* was lethal to American chestnut seedlings that were not protected by phosphite-based fungicides.

(2) The three phosphite compounds used in this study prevented mortality of American chestnut seedlings, and the relative effectiveness appeared to vary among the phosphites. However, additional experiments are needed to determine if these differences are real and statistically significant.

Ongoing and Future Work

Next steps will be to isolate *Phytophthora cinnamomi* from samples of the root systems of the plants used in this experiment. Phosphite treatments will be resumed on the second year survivors of this experiment after the plants have leafed out in the spring of 2009.

The experiment will be repeated in 2009 using slightly more than twice as many American chestnut seeds. These seeds were harvested by CC-TACF from wild American chestnuts on the Blue Ridge Parkway in North Carolina. In the 2009 experiment, four treatments will be compared. Subdue Maxx, applied as a soil drench, will be used in addition to the three phosphite products used in the 2008 work described in this article.

The results obtained provide very positive indications that *Phytophthora cinnamomi* infestations in American chestnut and hybrid chestnut plantings might be controllable. I encourage other investigations on the use of phosphites in controlling root rot disease. The American Chestnut Foundation and its cooperators would benefit greatly if phosphite compounds can be proven to be effective as systemic fungicides in controlling chestnut blight caused by Cryphonectria parasitica. Additional work on this front might lead to the development of a treatment program that makes possible the growth and preservation of specific American chestnuts to maturity.

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Northern Appalachian Regional Science Coordinator Sara Fitzsimmons of The American Chestnut Foundation provided the American chestnut seeds used in this experiment. These seeds were from "Jack's Hill Farm" in Pennsylvania. Steve Jeffers, Professor in the Entomology, Soil, and Plant Sciences Department of Clemson University, provided advice on the experimental design. Steve Jeffers and his laboratory research assistants prepared the inoculum used in this experiment. Joe James, of the Chestnut Return Farm in Seneca, SC, provided plant growing advice, education on Phytophthoras, and assisted in the inoculation of the experimental matrix. Fafard's Anderson, SC offices donated half and supplied at cost the other half of the planting mix used in this experiment.

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Meadowview Notes 2007-2008

by Frederick V. Hebard, Robert L. Paris and William Y. C. White
American Chestnut Foundation Research Farms, Meadowview, VA

Meadowview experienced drought conditions in 2007 and into 2008. However, there was enough rain during the 2007 growing season to make most crops, except hay, which suffered from drought in May and early June, when production peaks. The drought did not decrease chestnut production significantly, but did impair growth of new seedlings on some soils.

Inventory

Our current holdings are presented in Table 1, and changes from 2007 to 2008 are indicated in Table 2. We now have more than 47,000 trees and planted nuts, an increase of almost 14,000 over last year (Table 2). Most of the increase is due to the addition of B_3-F_2 trees, which increased by 13,071. Our holdings of other nut types are relatively constant, with plantings of those offset by removal, as we have made selections and rogued the rejects. However, the degree of backcrossing is increasing; for instance, we added 410 straight B_4s in 2008 and two new lines. Reclassification of some crosses also affected some statistics, for instance, when Chinese chestnut trees were reclassified as Chinese x Chinese trees if they were products of controlled crosses.

We were very fortunate this year to start planting B_3s from the 'Nanking' source of blight resistance at the Virginia Department of Forestry's Matthews State Forest in Grayson County, Virginia, which is adjacent to Meadowview's Washington County. We had needed an isolated location for 'Nanking' B_3s in order to harvest B_3-F_2s relatively free from pollen contamination. We plan currently to convert this breeding orchard in place into a seedling seed orchard. The planting at the Matthews was made possible by Ed Stoots, Wayne Bowman and Zack Olinger of the Virginia Department of Forestry, and their colleagues.

Harvest

The most exciting news is that we harvested 1,883 B_3-F_3 nuts in 2007, a ten-fold increase from the previous two years. Hopefully, the number of harvested B_3-F_3 nuts will exceed 20,000 in two or three more years! Some of these B_3-F_3 nuts were sown in forest nurseries in the winter of 2007-2008 to be set out into forest test plantings in 2009 in cooperation with the U.S. Forest Service.

In addition to National Forest plantings, B_3-F_3 nuts and seedlings also are being distributed to members, prioritized by seniority of membership.

The year 2007 saw our largest harvest ever, almost doubling the previous year's harvest. The main factor increasing the harvest was that almost all the straight B_3s from 'Clapper' and 'Graves' have now been screened for blight resistance and are approaching full production; we harvested 31,220 B_3-F_2 nuts from them.

In addition, we harvested almost 3,795 nuts from the new "Father Tree Program" where chapters bring American chestnut pollen to Meadowview to make crosses. This is especially advantageous for the southern chapters, where their American chestnut trees flower early, often before anthesis in Meadowview, necessitating use of last year's pollen. Additionally, due to *Phytophthora* root rot, many of their flowering American chestnut trees are on steep slopes and inaccessible to bucket trucks.

Finally, it was a good year for nut production in the Meadowview area, and many trees bore well. An exception was Chinese chestnut, which suffered from a hard freeze over Easter weekend of 2007, after starting to break bud due to warm weather in March. American chestnut, and most backcross trees were not affected by the freeze because they had not yet started to break bud.

Blight resistance screening in B_3-F_2 seedlings.

The year 2007 was the fourth in which we screened 'Clapper' B_3-F_2 seedlings for blight resistance and the third for 'Graves' B_3-F_2 seedlings. The results of the 'Clapper' seedlings are presented in Table 4 and those for the 'Graves' in Table 5. Unlike last year, there were no significant differences between 'Clapper' lines in blight resistance, but significant differences occurred between 'Graves' lines, as they had last year.

The resistance ratings were better for 'Graves' than 'Clapper' B_3-F_2s. but this may reflect better growing conditions at the farm with the 'Graves' than the farm with the 'Clapper' seedlings. This is the second round of chestnut planting at the 'Graves' farm, our original Wagner Research Farm, and chestnuts do better on these old agricultural soils in the second rather than the first round of planting.

We have now completed planting a fair proportion of our 'Clapper' B_3-F_2 lines, where planting of 1350 nuts marks completion. In 2008, we had completed planting 12 lines of Clapper B_3-F_2s and had started 27. For 'Graves', 4 lines are completely planted and 20 started. The rate of planting between 2002 and 2007 for Clapper lines is shown in Figure 1. Usually it has taken about 4 years to complete the breeding of those lines which are complete, ranging from 1 to 7.

We would like to thank Lou Silveri, Dave Lazor and Sam Fisher for helping with pollinations and inoculations. Special thanks to Dave Slack for volunteering two days a week all year round for the past three years! Also, we need to acknowledge the role of George Sykes, Danny Honaker, Darryl Caudell, Lori Hall, Louise Cottrell and many others in keeping the farms running from day to day. Thanks to all —this wouldn't get done without their help. If you are interested in helping to pollinate next year, plan on any time in June (call 276 944-4631). If you are interested in learning more about the Elder Hostel program, call 617 426-8055 or write 75 Federal St., Boston MA 02110.

We would like to remind all TACF members that you are welcome to visit the farms at any time. We are in a white house on the northeast side of Virginia Route 80, one-third of a mile southeast of Exit 24 on Interstate 81, the Meadowview Exit. We generally are there during normal work hours, but it might be good to call ahead (276 944-4631).

A Quick Guide to Chestnut Breeding Terminology

Parents		*Offspring*
American x Chinese	=	F_1, "F-one"
F_1 x F_1	=	F_2, F-two
F_2 x F_2	=	F_3, F-three
F_1 x American	=	B_1, first backcross, or B-one
B_1 x American	=	B_2, second backcross, or B-two
B_2 x American	=	B_3, third backcross, or B-three
B_3 x American	=	B_4, fourth backcross, or B-four
B_1 x B_1	=	B_1-F_2, B-one F-two
B_1-F_2 x B_1-F_2	=	B_1-F_3, B-one F-three
B_2 x B_2	=	B_2-F_2, B-two F-two
B_2-F_2 x B_2-F_2	=	B_2-F_3, B-two F-three
B_3 x B_3	=	B_3-F_2, B-three F-two
B_3-F_2 x B_3-F_2	=	B_3-F_3, B-three F-three

Table 1. Type and number of chestnut trees and planted nuts at TACF Meadowview Research Farms in May 2008, with the number of sources of blight resistance and the number of American chestnut lines in the breeding stock.

Type of Tree	Number of		
	Nuts or Trees	Sources of Resistance	American Lines*
American	2006		210
Chinese	562	54	
Chinese x American: F_1	475	21	79
American x (Chinese x American): B_1	522	14	29
American x [American x (Chinese x American)]: B_2	1744	11	43
American x {American x [American x (Chinese x American)]}: B_3	1796	9	81
Am x (Am x {Am x [Am x (Ch x Am)]}):B_4	440	3	5
(Ch x Am) x (Ch x Am): F_2	317	5	7
[Ch x Am) x (Ch x Am)] x [Ch x Am) x (Ch x Am)]:F_3	5	1	1
[Am x (Ch x Am)] x [Am x (Ch x Am)]: B_1-F_2	471	4	4
{Am x [Am x (Ch x Am)]} x {Am x [Am x (Ch x Am)]}:B_2-F_2	240	6	6
(Am x {Am x [Am x (Ch x Am)]}) x (Am x {Am x [Am x (Ch x Am)]}):B_3-F_2	31240	2	47
B_3-F_3	96	1	2
Chinese x (Chinese x American): Chinese B_1	184	3	4
Chinese x [American x (Chinese x American)]	41	1	1
Chinese x {American x [American x (Chinese x American)]}	435	5	16
Chinese x Chinese	2463	70	
Chinese x Japanese	109	2	
Chinese x European	140	1	
Chinese x Large, Surviving American	288	10	10
European	1	1	1
European x American F_1	2	1	1
Japanese	10	4	4
Japanese x American F_1	9	2	2
[(Japanese x American) x American] B_1	10	2	2
{[(Japanese x American) x American] x American} B_2	134	2	2
Japanese x European	157		
Japanese x Large, Surviving American	27		5
Castanea seguinii	48	3	3

Large Surviving American F_1	785	19	47
Large Surviving American B_1	446	8	31
Large Surviving American B_2	94	2	6
Large Surviving American I_1	1508	21	23
Large Surviving American I_2	364	6	6
Large Surviving American F_2	150	6	10
Large Surviving American other	64	6	6
Other	31		
Total	**47414**		

* The number of lines varied depending on the source of resistance. We will have to make additional crosses in some lines to achieve the desired number of progeny per generation within a line. In keeping with past practice, the number of lines for each source of resistance are added separately; thus, progeny from two sources of resistance that share an American parent would be counted as two lines rather than one line (this only occurs rarely).

Table 2. Changes between 2007 and 2008 in the number of chestnut trees and planted nuts of different types at TACF Meadowview Research Farms, including changes in the number of sources of blight resistance and the number of American chestnut lines in the breeding stock.

Type of Tree	Increase or Decrease* in number of		
	Nuts or Trees	Sources of Resistance	American Lines
American	-155		-12
Chinese	-587	1	
Chinese x American: F_1	-36	1	-4
American x (Chinese x American): B_1	-60	-2	-11
American x [American x (Chinese x American)]: B_2	61	0	-52
American x {American x [American x (Chinese x American)]}: B_3	113	0	3
Am x (Am x {Am x [Am x (Ch x Am)]}):B_4	410	0	2
(Ch x Am) x (Ch x Am): F_2	64	0	-2
[Ch x Am) x (Ch x Am)] x [Ch x Am) x (Ch x Am)]:F_3	-1	0	0
[Am x (Ch x Am)] x [Am x (Ch x Am)]: B_1-F_2	0	0	-2
{Am x [Am x (Ch x Am)]} x {Am x [Am x (Ch x Am)]}:B_2-F_2	17	1	-1
(Am x {Am x [Am x (Ch x Am)]}) x (Am x {Am x [Am x (Ch x Am)]}):B_3-F_2	13071	0	12
B_3-F_3	-121	0	-3
Chinese x (Chinese x American): Chinese B_1	-7	0	1

Chinese x [American x (Chinese x American)]	0	0	0
Chinese x {American x [American x (Chinese x American)]}	435	5	16
Chinese x Chinese	208		
Chinese x Japanese	0		
Chinese x European	0		
Chinese x Large, Surviving American	260		
European	0	0	0
European x American F_1	0	0	0
Japanese	-3	1	1
Japanese x American F_1	-2	0	0
[(Japanese x American) x American] B_1	0	0	0
{[(Japanese x American) x American] x American} B_2	1	0	0
Japanese x European	0		
Japanese x Large, Surviving American	-15		
Castanea seguinii	0	0	0
Large Surviving American F_1	237	4	15
Large Surviving American B_1	-85	0	4
Large Surviving American B_2	0	0	0
Large Surviving American I_1	97	2	2
Large Surviving American I_2	364	6	6
Large Surviving American F_2	-224	1	0
Large Surviving American other	-82	-4	-7
Other	-155		-12
Total	**13958**		

* The decreases in Chinese, F_1, B_3, and Large Surviving American trees reflects rouging of trees with inadequate levels of blight resistance. The increases reflect further breeding and collecting.

Table 3. The American Chestnut Foundation Meadowview Farms 2007 nut harvest from controlled pollinations and selected open pollinations.

Nut Type*	Female Parent	Pollen Parent	Pollinated			Unpollinated Checks			Number of American Chestnut Lines**
			nuts	bags	burs	nuts	bags	burs	
B_1	American	F_1 mollissima12	21	69	137	0	7	20	1
B_1	F_1 mollissima10	American	0	10	21	0	0	0	1
B_1	F_1 mollissima7	American	7	62	124	0	12	16	1

Nut Type*	Female Parent	Pollen Parent	Pollinated			Unpollinated Checks			Number of American Chestnut Lines**
			nuts	bags	burs	nuts	bags	burs	
B_1-F_3	B_1-F_2 Clapper;Graves	open pollinated	4351		2419				10
B_2	American	B_1 72-211	15	81	201	3	8	24	1
B_2	B_1 72-211	American	26	65	82	0	4	5	1
B_2	B_1 MusickChinese	American	118	110	264	0	13	28	3
B_2	B1 Nanking	American	538	635	1762	3	51	142	9
B_2-F_2	B_2 Nanking	B_2 Nanking	19	76	227	0	8	18	1
B_2-F_3	B_2-F_2 Mahogany	open pollinated	655		405				1
B_2-F_3	B_2-F_2 opClapper	open pollinated	2446		1471				2
B_3	American	B_2 Douglas	255	89	141	1	10	19	4
B_3	American	B_2 Meiling	113	98	134	0	8	16	1
B_3	American	B_2 Nanking	598	260	655	8	30	71	9
B_3	American	B_2 R11T14	14	44	120	1	4	6	3
B_3	B_2 Meiling	American	2	10	10	0	2	0	1
B_3	B_2 Nanking	American	441	157	400	0	14	51	6
B_3	B_2 R11T14	American	207	180	539	0	19	73	2
B_3-F_2	B_3 Clapper	open pollinated	19663		12456				50
B_3-F_2	B_3 Graves	B_3 Graves	90	117	255	1	10	29	3
B_3-F_2	B_3 Graves	open pollinated	11467		8699				37
B_3-F_3	B_3-F_2 Clapper	open pollinated	1883		1062				10
B_4	American	B_3 Douglas	16	76	140	0	7	14	2
B_4	American	B_3 R11T14	185	41	141	0	5	22	1
B_4	American	B_3 R1T7	489	309	799	11	34	88	17
B_4	B_3 R11T14	American	6	41	74	0	4	6	2
B_4	B_3 R1T7	American	192	54	129	0	5	10	2
F_1	American	Chinese Meiling	56	36	60	0	4	11	1
F_1	American	Chinese Nanking	110	166	338	0	15	39	8
F_1	American	Chinese Vanuxem	84	65	157	0	7	11	4
Japanese B_2	Japanese B_1 PI#104016	American	10	8	9	0	1	1	1
LSA B_1	American	LSA F_1 NCChamp	421	87	239	0	9	21	1
LSA B_1	Irradiated F_1 NC$F_1$79	American	91	97	363	1	12	33	1
LSA B_1	LSA F_1 Corrigan	American	340	118	210	0	11	16	3
LSA B_1	LSA F_1 NCChamp	American	55	68	69	0	7	8	2

Nut Type*	Female Parent	Pollen Parent	Pollinated			Unpollinated Checks			Number of American Chestnut Lines**
			nuts	bags	burs	nuts	bags	burs	
LSA B_1	LSA F_2 DaresBeach	American	5	3	6	1	1	4	1
LSA B_1	LSA F_2 Ort	American	1063	312	739	1	20	60	4
LSA B_1	LSA I_1-F_1 opWeekly	American	21	11	13	0	1	1	1
LSA B_2	LSA B_1 Corrigan	American	0	3	6	0	1	1	1
LSA F_1	American	LSA I_1 SciCliffs;Gault	510	124	257	0	9	31	1
LSA F_1	LSA B_1 DaresBeach	LSA F_1 DaresBeach	28	23	74	0	2	5	1
LSA F_1	LSA op CareyMa-con2	American	7	11	13	0	1	1	1
LSA F_2	LSA F_1 NCChamp	LSA F_1 NCChamp	8	164	166	0	15	15	1
LSA I_1	LSA F_1 DaresBeach	LSA B_1 DaresBeach	60	25	51	0	2	3	1
LSA I_1	LSA F_1 NCChamp	LSA F_1 Amherst	80	114	237	0	14	27	1
LSA I_1	LSA F_1 NCChamp	LSA op WayahBig	0	33	28	0	4	8	1
LSA I_1	LSA F_1 Ort	LSA F_1 NCChamp	30	26	33	0	1	3	1
LSA I_1	LSA F_1 Ort	LSA op WayahBig	62	146	140	8	11	12	1
LSA I_1	LSA I_1 SciCliffs;Gault	LSA F_1 Amherst	111	41	118	0	4	12	1
LSA I_1	LSA op WayahBig	LSA F_1 NCChamp	38	33	71	0	3	3	1
LSA I_2	LSA F_1 Amherst	LSA I_1 SciCliffs;Gault	14	25	43	0	2	1	1
LSA I_2	LSA I_1-F_1 opDares-Beach	LSA I_1 SciCliffs;Gault	47	12	28	0	2	3	1
LSA I_2	LSA I_1-F_1 opWeekly	LSA I_1 SciCliffs;Gault	383	91	216	4	7	16	1
B_3&B_4	chapter		3795	2605	6488	48	250	784	38
CxC	Fifteen Chinese	Meiling Chinese	492	232	510	0	27	56	
CxC	Twelve Chinese	Nanking Chinese	494	156	343	0	18	30	
CxC	Eight Chinese	Vanuxem Chinese	72	74	132	0	10	16	
B_3xC	Seven B_3s	Meiling Chinese	150	194	484	0	18	36	7
B_3xC	Seven B_3s	Nanking Chinese	546	184	543	2	22	51	7
B_3xC	Seven B_3s	Vanuxem Chinese	173	172	443	1	20	50	7
LSAxC	Three LSAs	Meiling Chinese	37	75	124	0	5	16	3
LSAxC	Seven LSAs	Nanking Chinese	287	132	264	2	14	32	7
LSAxC	Two LSAs	Vanuxem Chinese	27	43	93	0	4	11	2
B_3-I_2	Clapper B_3	Graves B^3	53	31	46	0	5	9	1

Nut Type*	Female Parent	Pollen Parent	Pollinated			Unpollinated Checks			Number of American Chestnut Lines**
			nuts	bags	burs	nuts	bags	burs	
other			119	84	143	17	0	6	
Total Controlled Pollinations, w/o Chapter			**9461**	**5951**	**13563**	**48**	**589**	**1375**	

*LSA denotes Large, Surviving American, being an American chestnut over 13 inches in diameter at breast height (54 inches) that has blight but has survived longer than approximately 10 years.

**The number of American lines for this table is restricted to the number of American chestnut trees that were direct parents, not grandparents, of progeny.

Table 4. Number of 'Clapper' B_3-F_2 seedlings ranked in various blight resistance classes in 2007.

Susceptible Great Grandparent	LS Mean Resistance Rating**		Standard Deviation of Resistance Rating	Number of Progeny Tested	Blight Resistance Class*		
					3	4	5
QBA1CL	4.1	A	0.7	281	91	110	80
QBF3CL	4.1	A	0.7	30	9	12	9
RCF1C	4.2	A	0.7	39	11	12	16
LFR4T14	4.2	A	0.7	87	23	26	38
LFR4T12	4.2	A	0.8	42	13	8	21
HBW1C	4.2	A	0.8	60	20	8	32
HBW3C	4.3	A	0.7	15	3	5	7

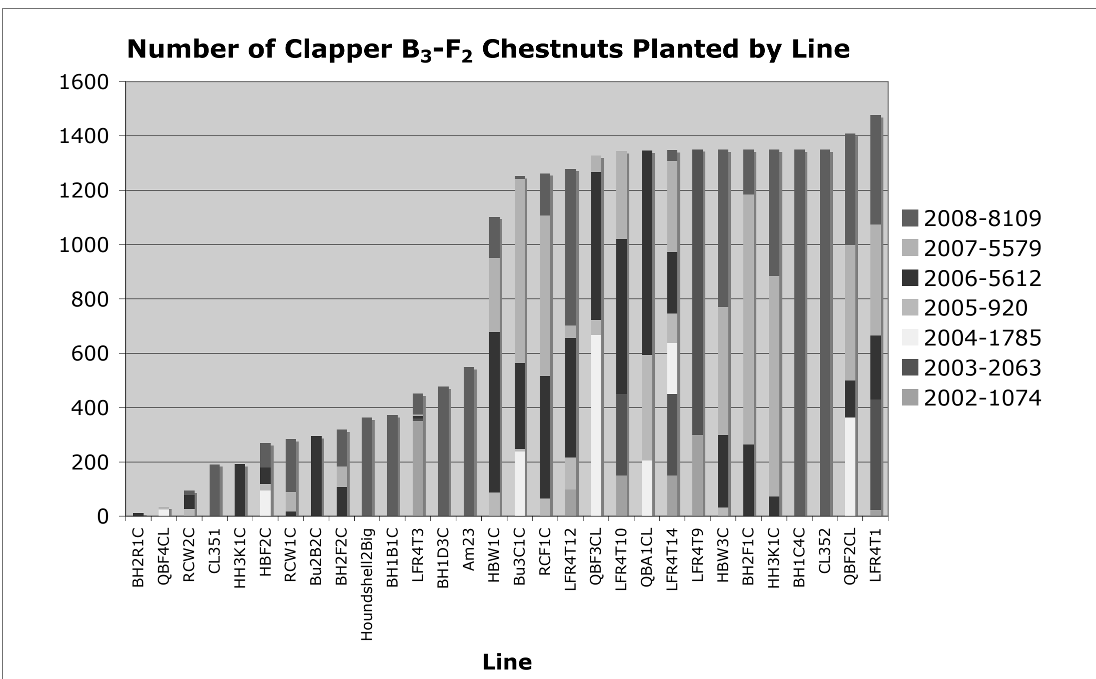
* Trees were only inoculated with a weak, but virulent strain of the blight fungus in early June. A rating of 3 indicates that the cankers were small, about 1-cm long, 5 months after inoculation. A rating of 4 indicates the cankers were slightly larger, 2-4 cm long, and a rating of 5 indicates the cankers were over 5 cm long.

** Means followed by the same letters are not significantly different at $p<.0.05$ by a Tukey-Kramer HSD test.

Table 5. Number of 'Graves' B_3-F_2 seedlings ranked in various blight resistance classes in 2007.

Susceptible Great Grandparent	LS Mean Resistance Rating**		Standard Deviation of Resistance Rating	Number of Progeny Tested	Blight Resistance Class*		
					3	4	5
Bu3C3C	3.8	B	0.8	304	149	85	70
Hesper-McGreg	3.8	AB	0.5	19	5	13	1
RCF5GR	4.1	AB	0.8	9	3	3	3
PaulGalloway	4.1	A	0.7	69	19	29	21

* & ** See footnotes to Table 4.



From Then to Now

TACF Regional Science Coordinators Reports

New England Regional Science Report

by Kendra Gurney, TACF New England Regional Science Coordinator, South Burlington, VT

The year 2008 was exciting for the New England chapters of TACF. The Maine and Massachusetts chapters continued with inoculations and selections and are currently exploring options for establishment of New England's first seed orchards. The Connecticut and Vermont/New Hampshire chapters continued their breeding work with a busy year planting at new and existing orchards and pollinating new and repeat trees to complete lines. The year 2008 also marked the transition from previous New England Regional Science Coordinator Leila Pinchot, who is now a doctoral candidate working with chestnut at the University of Tennessee in Knoxville, to Kendra Gurney, now headquartered at the USFS Northern Research Station in South Burlington, VT. Leila will be missed by the New England chapters, but all wish her the best of luck and congratulate the Tennessee chapter on the addition of a valuable new member.

Maine

The Maine chapter kicked off the 2008 field season with continued selection work at the Merryspring and Groce orchards, both inoculated in 2007. Ratings and selections, conducted with the guidance of Dr. Fred Hebard in May and again in October, pinpointed some good candidates for the next round of crosses. A group of approximately 15 members inoculated the Deer Hill orchard in June, inoculating 211 trees from 4 lines. Initial ratings were made in October and will be continued in 2009. Inoculation of the second Deer Hill orchard is also planned for 2009.

With all this inoculation and selection work well underway, the Maine chapter is looking to identify partners for establishing their first seed orchard. In January 2009, ME-TACF president Glen Rea met with a team from the US Forest Service and

University of Maine to discuss the possibility of planting a seed orchard on the Penobscot Experimental Forest in Bradley, ME. The forest managers were strongly in favor of supplying the necessary land. Scouting for appropriate sites will begin this spring. The first seed for this orchard should be collected in the fall of 2009 and planted in 2010. The Maine chapter has also discussed the option of purchasing an acre or two on which to plant a couple blocks of their seed orchard.

ME-TACF has already created 22 'Clapper' and 20 'Graves' lines and, as a result, pollination work has slowed a bit. This year the chapter pollinated the Orono tree for the fourth and final time. The squirrels have really been a problem with this tree and its health has been declining. Luckily, the 28 nuts harvested this year will be enough to complete the line. The chapter also harvested open-pollinated American seeds from groves in Atkinson, Cornville, and Rockport, with harvest totals well over 2,000 nuts.

Atkinson Grove Update

The Atkinson Grove, featured in several recent issues of *The Journal* and *The Bark*, has recently gone up for sale. It is hoped the grove, approximately 15 acres within a much larger parcel, will be purchased by a conservation group and management will be left to the University of Maine and the Maine chapter of TACF. An interested conservation organization has been identified and the Maine chapter will be watching the progress closely to ensure this rare, large grove of American chestnut remains protected.

Cookie cut from one of the largest trees in the Atkinson Grove to succumb to blight. In its last 15 years of life, this tree put on one inch in diameter growth/year and was approximately 75 years old and 27" DBH at the time it was cut. Photo courtesy of Kendra Gurney.

Vermont/New Hampshire

The first full year as a chapter was a busy one for Vermont and New Hampshire. The chapter started the year with a snowy February meeting, but quickly moved to warmer tasks, planting two new breeding orchards in May. One orchard, planted at High Shelter Farm in Perkinsville, VT involved a large group of volunteers, many travelling two hours or more to help out. The event generated several news stories, including a TV appearance by landowners and chapter president and vice-president, Grace and Randy Knight and chapter secretary, Terry Gulick. The second orchard, planted at Shieling Forest in Peterborough, NH is the first NH orchard for the chapter and was established through a partnership with the state. The NH Department of Resources and Economic

Development's Division of Forests and Lands has proved a great partner to the VT/NH chapter, providing the land and maintenance for this orchard, as well as planting seedlings for orchard replacements at the NH State Nursery.

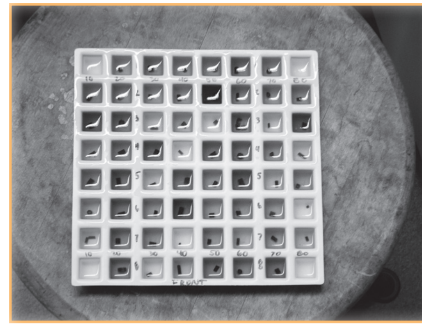
Pollinations continued in 2008 with the inclusion of three new trees (one of which died before harvest) and four repeat pollinations, harvesting a total of almost 700 nuts. To date the chapter has created 10 'Graves' lines from eight trees in VT and only two in NH. Looking ahead, the chapter plans to balance out this distribution by focusing on more pollination efforts in NH. Pollination at Ballard State Forest in Derry, NH generated press coverage, resulting in many new reported NH trees and good potential for the chapter to better distribute their pollination efforts next year.

The Thetford Tree located near the Connecticut River in Vermont. A beautiful chestnut, this tree is not 100% American and has taught the VT/NH Chapter the science of sample identification is not always as simple as it seems. Photo courtesy of Kendra Gurney.

Thetford Tree

The Thetford tree has been a hot issue for the VT/NH Chapter in 2008. A beautiful, tall, spreading chestnut, this tree was a favorite of many in the chapter. The tree had been identified by a variety of scientists in the past, with conflicting opinions as to the species. In an attempt to achieve consensus, this year samples were collected and sent to a number of different ID experts, who reported back a number of different species diagnoses ranging from American to European to a hybrid of the two. A second round of samples were collected and circulated as a set, allowing each identifier to look at the same collection of samples. Some ID features did not show up on all samples, but this second round helped to clarify the tree is not 100% American chestnut, though it certainly possesses many American characteristics. The final verdict is: the tree has too many European chestnut characteristics to ignore and is likely some level of American-European hybrid. This leaves the chapter the issue of deciding what to do with the seed collected this year, as well as the seedlings already planted.

Cold Tolerance Work



Tray of sample material used for assessing shoot cold tolerance of chestnut in relation to oak and maple. Note the lighter cells contain maple, as oak and chestnut leak more tannin in solution. Shoots are exposed to a series of sequentially lower sub-freezing temperatures and resulting cell damage is measured as a method of determining cold tolerance thresholds. Photo courtesy of Kendra Gurney.

Dr. Paul Schaberg is leading a research group from the University of Vermont and US Forest Service to look at shoot and seed cold tolerance of American and backcross chestnut in relation to native competitors. A cursory study of shoot cold tolerance found American and VT backcross chestnut to be less cold-hardy than red oak and sugar maple growing in the same sample area. Results of this study were recently accepted for publication in the journal *Restoration Ecology*. A follow-up experiment is planned for spring planting and will look at a variety of sources of American chestnut from throughout the range. Seedlings will be planted in the Green Mountain National Forest under different thinning treatments to determine if, and how genetic background, environmental conditions, or a combination of the two may influence chestnut cold tolerance. Seed from these sources will also be tested for cold tolerance this winter. A preliminary study found American chestnut seed was slightly less cold-tolerant than native red oak acorns, but found no geographic or altitudinal pattern for variations among chestnut sources. It is hoped with a better distribution of sources and fine-tuned methods, additional experimentation will provide a better look at differences in cold tolerance among seed sources. By using the same sources in the seedling and seed studies, it will also be possible to determine if seed and shoot cold tolerance levels are matched per source.

Massachusetts

The year 2008 was productive for the Massachusetts chapter. In the spring they continued planting, adding two new breeding orchards to their impressive list. These orchards, located in Dartmouth, MA and Glocester, RI bring the chapter's grand total to 29 orchards – 27 in MA and 2 in RI. Additional plantings were also conducted at the Westerly, Stockbridge and Lancaster orchards. A new partnership with the South Kingston Land Trust and University of Rhode Island was established this year and orchard number 30 should be added to the list next spring. It is through the dedicated work of the chapter's orchard managers and active board that MA-TACF sustains their numerous plantings.

Four trees were pollinated by MA-TACF this summer, three of which represented new lines: two new 'Clapper' and one 'Nanking'. This brings the chapter's total lines to 41: 21 'Graves', 19 'Clapper' and 1 'Nanking'. In addition there are 14 small lines: 8 'Graves', 5 'Clapper' and 1 'Nanking'. The chapter hopes to include one more 'Nanking' line, as well as a few new ones for the Rhode Island orchards, and will continue such pollinations in 2009. In addition to creating these crosses, the chapter may turn efforts towards finding successful combinations for F_1 crosses and re-pollinating to complete existing lines.

Ratings and selections continued at Tower Hill orchard this year. Inoculated in 2007, five trees from three lines were selected by Leila Pinchot in June. The chapter continued inoculations this summer and in June inoculated the Wrentham orchard, which had abundant natural blight infection. While not all trees were large enough, 66 trees from 5 lines were inoculated. Initial ratings were conducted under the guidance of Dr. Fred Hebard in October and will continue in 2009. Three more orchards may be ready for inoculation next year as well. With the inoculations and selections well underway, the Massachusetts chapter is looking ahead to seed orchards and hopes to collaborate with the MA Department of Conservation and Recreation—a proven partner—as well as identifying new opportunities for this important next step.

Exotic Threat

This summer saw the introduction of the Asian Long-Horned beetle (ALB) to Worcester, MA, not far from one of the chapter's orchards. This exotic beetle is extremely damaging to hardwoods, especially maples, and it is uncertain if chestnut could also be a target. Preliminary research suggests that this beetle prefers other species over oaks and beeches so would presumably also not prefer chestnut. The MA Department of Agricultural Resources and U-Mass Extension Agriculture and Landscape Program are working to eradicate this introduced pest from parts of five towns; however this is no easy task and highlights the problem of introduced pests and pathogens which continue to threaten our forests.

Ice Storm of 2008

In mid-December an ice storm left much of New England in the dark for several days. Areas of Massachusetts were some of the hardest hit, with power out for up to a week or more in some places. Thick ice took down many large branches and trees, and the young, brittle chestnuts in the Ashfield/Hawley orchard did not provide exception. Luckily, this orchard was the only one damaged as a result of the storm. Central parts of the state were reported to have sustained the worst damage seen in at least 30 years by line workers; however the orchards in these devastated areas miraculously came through unscathed. It is hoped with some clean-up, the Ashfield/Hawley orchard will bounce back in short order.

Reforestation Studies

Seedling planted at the Quabbin Reservoir as part of MA-TACF's reforestation studies. Photo courtesy of Leila Pinchot.

In an effort to continue defining the best methods for forest planting of chestnut in Massachusetts, MA-TACF continued to conduct reforestation plantings in 2008. In the spring, Bruce Spencer and Rufin Van Bossuyt planted chestnut seeds (in shelters) and a few seedlings at three sites around the Quabbin Reservoir. All sites have been recently harvested and provided openings of one third to one half of an acre. The first site, a flat area with fertile, moist soil, had most recently supported a pine stand. At the end of the growing season, 77% of all seeds and seedlings planted survived. The second site, an upland area about 100 feet higher than the first site, most recently supported oak, hemlock, and pine, as well as chestnut sprouts. These were more ideal chestnut conditions as an eastern slope of well-drained till provided a survival rate of 47% for all seeds planted. The final site, an upland area similar to the second site but with a steeper southern aspect, was the least successful, with only 18% of seeds planted producing a seedling by the end of the season.

Connecticut

Breeding work is still in full swing in Connecticut and 2008 was a year of planting and pollinating. A new orchard was established in Guilford in collaboration with the Guilford Conservation Commission, and additional lines were planted at the four other breeding orchards in the state. Planting is mostly complete at the Woodbridge and Ellington orchards; however additional lines will be planted at the Salem, Great Mountain, and Guilford orchards in 2009 and beyond. It is hoped the five existing breeding orchards will accommodate the chapter's goal of 20 'Clapper' lines; however additional test orchards have been established, with more planned for 2009. While still a few years off, the chapter has already started to think about seed orchards and will begin outlining site criteria as next steps approach.

The Connecticut chapter pollinated six trees this year, four of which were new mother trees, bringing the total count to 12 full 'Clapper' lines. Unfortunately, three of the new trees died back significantly before harvest and yield was relatively low. CT-TACF is still on the hunt for additional mother trees and plans to continue creating new lines in 2009. The chapter does not have any current plans to breed for a second source of resistance,

Former New England Regional Science Coordinator Leila Pinchot and Kneeland Munson help Housatonic Valley Regional High School students plant additional seeds at the Great Mountain Forest breeding orchard in Falls Village, CT. Photo courtesy of Kendra Gurney.

Tip die back of seedlings in CT-TACF's Ellington orchard was caused by scolitids, tiny tunneling insects identified by the Connecticut Agricultural Experiment Station. This is an uncommon pest on chestnut and it is hoped it will be less of a problem in 2009. Photo courtesy of Gayle Kida.

but with 12 'Clapper' lines already in existence they are more than halfway there.

Partnership for Success

CT-TACF continued their partnership with Northeast Utilities this year, hosting a picnic and check hand-off at the new Guilford orchard on one of the hottest days of the summer. Northeast Utilities, headquartered in CT, runs a program to address environmental concerns and one component of this program has been designated to support TACF. Shareholders may opt to receive their year-end report electronically, and the company passes on their savings of $5 per shareholder to TACF, three-quarters of which are designated for the CT chapter to support their local work. In 2008 Northeast Utilities raised close to $8,500, for a total donation of almost $17,000 since the program began in 2007.

Scolitids in Ellington

This past summer, curious stem dieback became an issue at the Ellington orchard. First noticed by Northern Connecticut Land Trust volunteers in 2007, the problem became more widespread in 2008. In July, breeding coordinator Gayle Kida began searching for the culprit and the standard causes did not seem to fit. Samples from the affected trees were sent to the Connecticut Agricultural Experiment Station and the culprit was identified by Dr. Gale Ridge. Scolitids are tiny insects which may tunnel into the stems of trees to lay their eggs. While they typically cause little damage, the wilt and dieback on stems of chestnuts no more than a year and a half old was concerning. Dr. Ridge took additional stem samples in August and believes this particular species of scolitid may be currently unidentified. Traps will be set in March and the orchard will be monitored through July of 2009, in hopes of better identifying this tiny pest.

Northern Appalachian Regional Science Report

Sara Fitzsimmons, TACF Regional Science Coordinator, Penn State University, University Park, PA

New York

The New York Chapter continues to work toward the development of a blight-resistant American chestnut utilizing genetic transformation techniques. During 2008, Dr. Bill Powell and Dr. Chuck Maynard inoculated the first transformed trees which were outplanted in 2006 and 2007. These trees, named after founding members of the New York Chapter Stan and Arlene Wirsig, include the *OxO* construct, which contains an oxalate oxidase gene from wheat that can detoxify oxalic acid produced by the chestnut blight fungus. These first transgenic American chestnut trees produce very low levels of the oxalate oxidase.

Upon inoculation, the trees exhibited resistance reactions similar to those displayed on younger trees which have been inoculated in TACF's BC_3F_2 orchards (Figure 8). It appears this reaction occurs as a result of the accumulation of sugars above the point of inoculation. Since the fungus girdles the tree, at some point, no transfer of nutrients past that point can take place. The Wirsig chestnut tree's stems survived twice as long as the wild-type American chestnut seedlings and the wild-type seedlings didn't show any resistance reactions. This indicates the *OxO* construct can enhance resistance a bit even when expressed at a very low level.

Figure 8. Picture of a BC_3F_2 seedling at the Arboretum at Penn State University. This photo is taken approximately 6 months following inoculation. Photo courtesy of Sara Fitzsimmons.

New trees, also using the *OxO* gene, were outplanted in the fall of 2008. These trees were named after, and planted by, Herb and Jane Darling. These new 'Darling' chestnut trees express the oxalate oxidase gene at a much higher level than the original 'Wirsig' chestnut trees and therefore it is hoped the resistance levels will also be higher. Future work will continue on the *OxO* construct and on other gene constructs. For example, the newest gene construct which will be used in future transformations will contain a laccase gene from the Chinese chestnut.

New plantings and coordinated research will focus on observing the potential impact of these transgenic trees on the surrounding ecology. In order to obtain EPA (Environmental Protection Agency) and USDA (U.S. Department of Agriculture) permitting for outplanting of genetically transformed material, multi-year research must show these trees do not perform differently than non-transformed trees. The transformed trees will be planted with American chestnuts, Chinese chestnuts, and some American/Chinese hybrids to make certain the characteristics such as insect feeding, nutrient breakdown, and soil biota are no different around the transformed material than they are on the non-transformed chestnut trees.

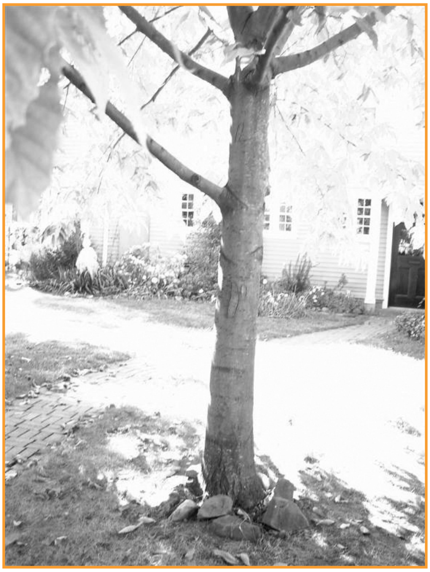


Figure 9. Backyard chestnut tree planted in Plainfield, NJ. Photo courtesy Tony Rosati.

Figure 10. Many thanks to the volunteers who helped inoculate the trees at the Quakake orchard. Jim Schuetrumpf (orchard owner), Jack Shafer, Vicki Brownell, Joe Lankalis, and Nancy Kyle. Photo courtesy Sara Fitzsimmons.

New Jersey

Several plantings continue to be maintained in New Jersey. The state currently has two Chinese chestnut research plots, established to observe segregation for resistance, three CMS/MSR (cytoplasmic male sterility/multiple sources of resistance) plantings, and several American chestnut testing orchards. There are many American chestnuts in the state, but the main holdings which have been utilized occur in the northern part of the state and near the shore in Monmouth County.

A new "backyard" tree was recently discovered in Plainfield (Figure 9). Though this tree was planted from Michigan stock, it can still be useful towards the breeding of research stock, as well as an item of interest which can help raise awareness on the work of The American Chestnut Foundation. A blog about this tree, and others in New Jersey, may be reached at: http://plainfieldtrees.blogspot.com/

Pennsylvania

The Pennsylvania Chapter continues work on several fronts. The Chapter completed breeding on its 20 BC_3/BC_4 lines each of 'Clapper' and 'Graves' source material, but there is still a good deal of work to do!

First is the inoculation of the 'Clapper' and 'Graves'—and other—material (Table 1). Almost 700 trees, including a planting of BC_3F_2 material, was inoculated in the summer of 2008 (Figure 10). Results of these inoculations should appear in the next update, especially results concerning the segregation of blight resistance in

Orchard	Location	Generation	Resistance	Number Inoculated
Quakake	Quakake, PA	F_1/BC_1	CAES	15
Ober	Stahlstown, PA	BC_3	Clapper	46
Hummelstown	Hummelstown, PA	BC_3	Clapper	25
Kuhns	Rock Springs, PA	BC_3	Clapper	150
Carbaugh	Danville, PA	BC_3F_2	Clapper	450

Table 1. Summary of trees and locations where PA-TACF inoculations occurred in 2008.

the Carbaugh BC_3F_2 planting and compared to similar material planted at the Penn State University Arboretum. Final selections of this material will take place in the early summer of 2009.

Large plantings of BC_3F_2s should continue at the Penn State Arboretum. A new "reforestation demonstration" orchard will be established in Lancaster County. Several intercross generations will be planted, primarily to showcase and observe—side-by-side—the long-term growth potential and form of BC_1F_3, BC_2F_3, and BC_3F_2 material. Several hundred of each type will be planted on land owned by the Lancaster County Conservancy.

Strip-Mined Research

Gary Gilmore, PA-TACF member and district forester for PA's DCNR (Department of Conservation and Natural Resources), has established a long-term study of several tree species planted on long-abandoned strip-mined land. Though the initial focus of this study will be the determination of best practices toward establishing hardwoods on long-abandoned strip mine sites, there will also be a small wildlife biology component. In association with researchers from Penn State University's Dubois campus, Gary will observe the effects of reclamation methods – subsoiling and herbicide application, and their effects on rodent predation. This study will take place on TACF's Smith Farm located in Coal Glen, Jefferson County, PA.

In addition to that study, three separate sites were established as part of TACFs partnership with the Appalachian Regional Reforestation Initiative (ARRI) and the Office of Surface Mining (OSM). These sites are located in Clearfield, Lycoming, and Sullivan Counties.

Gall Wasp

The oriental gall wasp (*Dryocosmus kuriphilus*) continues to invade Pennsylvania. A long-time chestnut orchard pest in China and Japan, the gall wasp was unwittingly imported into Georgia in the early 1970s. The pest has been marching northward ever since. In 2007, galls were found in Maryland and southern Pennsylvania. In 2008, galls were discovered in northwestern PA, primarily in Mercer and Erie Counties.

Ohio

Several long-standing initiatives finally came to completion during 2008. The Chapter signed Memorandum of Understandings (MOUs) with both the U.S. Fish and Wildlife Service and the Division of Forestry within the Ohio Department of Natural Resources (ODNR).

In 2007, the Chapter worked with the state tree nursery in Marietta to grow almost 10,000 pure American chestnut seedlings. Unfortunately, the nursery was discontinued, but all those one-year-old seedlings will be distributed through the county's Soil and Water Conservation Districts.

Though the Marietta Nursery was discontinued, the Chapter has signed an agreement with the Department of Forestry in West Virginia. The Clemants Tree Nursery is practically across the Ohio River from the Marietta Nursery. An MOU was signed to have future seedlings for OH-TACF be planted at the Clemants facility.

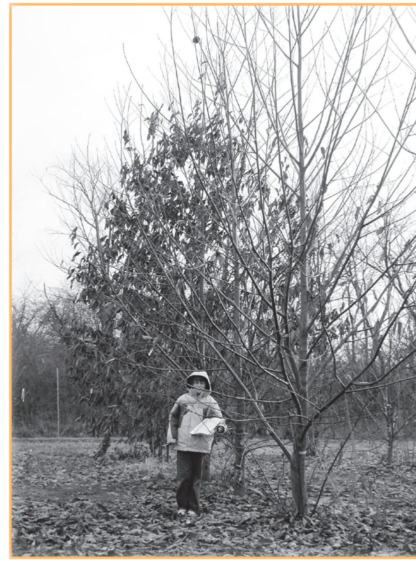
Using material from the Gratland Orchard in northern Maryland, the Ohio Chapter is starting a CMS/MSR research orchard at Dysart Woods Laboratory in Belmont County. This planting will contain BC1 material derived from some of the first CMS/MSR material planted by Ann and Bob Leffel in 2000. This orchard will be vital in following the segregation patterns for male sterility. Dr. Leffel hypothesizes the BC1 generation will segregate in a 1:1 ratio, with 50% of the trees being male sterile and the other 50% being male fertile. Time will tell!

Strip-Mined Plantings

Much work continues observing the capacity to plant and grow American chestnuts on strip-mined land. OH-TACF president, Dr. Brian McCarthy, is heading up large research plantings out of his lab at Ohio University. New plantings were established at Jockey Hollow Wildlife Management Area on fresh end-dump reclamation (Figure 11).

Indiana

The Indiana Chapter had another fruitful year. Though the first inoculations for the Chapter occurred in 2001, there were not any backcross trees large enough to warrant inoculation until 2008. In 2008, almost 300 trees from six 'Clapper' lines were inoculated across 3 different orchard locations. Based on preliminary ratings, approximately 30% of those trees inoculated exhibited moderate resistance. Final ratings will be taken in the early summer of 2009 and final selected material will be left to interbreed in the upcoming years.



Joe McKenna stands within inoculated trees at Purdue's Research Station, fall 2008. Photo courtesy of Jim McKenna.

Jim McKenna, operational Tree Breeder at Purdue University, worked to inoculate several large Chinese chestnuts also located at Purdue University's Horticulture Farms. Jim hopes to see any potential differences in resistance which might help researchers zero-in on what drives blight resistance in Chinese chestnuts. By looking at molecular backgrounds of trees which are resistant vs. trees which exhibit less resistance, it may be possible to focus on regions that control the trait.

For pollinations, since the Chapter completed its 20 lines of 'Clapper' material in 2007, Indiana continued to produce BC_3F_2 material from the 'Clapper' source of resistance. Since material from only one backcross line in the Indiana Chapter has been selected, pollen from selected BC_3 material in the PA Chapter was used to create those BC_3F_2s. The resulting 700+ seed will be planted at the Potawatomi Wildlife Park in Tippecanoe, IN.

Potomac Regional Report

Robert Strasser, Research Biologist, Hood College, Frederick, MD

All three states which border the Potomac River (VA, MD, WV) had important milestones during 2008. These three chapters of TACF are at the heart of the historic range of *Castanea dentata*, which extends from the Chesapeake Bay estuary to the broad mountainous expanse of the Appalachian Plateau. Preservation of surviving *Castanea dentata* in the region is the primary focus of most state chapter activities, and

Stanback Intern Tom Ladson assisting with hypovirulence inoculations. His energy and self reliance were of great value during the busyness of summer field operations in Pennsylvania, Maryland, Virginia, and West Virginia. Photo courtesy of Barbara Knapp.

will add to the genetic diversity of both our hybrid and pure American chestnut plantings for the future of the science. I am deeply grateful to all TACF members and partners for their efforts in helping restore chestnut to the eastern forests.

Maryland

Maryland's biggest milestone was it fulfilled the core chapter goal of planting 20 'Clapper' lines using mother trees in the state (Table 2). The Chapter is also more than halfway through the process of advancing the "Musick' source of resistance to the B_2 stage. The chapter has a breeding program which has come of age very quickly since beginning controlled pollinations in 2005. Now the focus is growing approximately 4,000 trees to an age when they can be selected and advanced through further breeding to make both B_3F_2 and B_4F_2 material for seed orchard establishment. It is also anticipated that some of the selections will be advanced through further backcrosses to the B_5 level in fulfillment of the goal of taking a small amount of selected lines to the B_6F_3 goal in coming decades.

Resistance Source	Generation Produced	Number of Trees Planted	Number of Locations Planted	Number of Meadowview Pollens	Number of Americans Used
Clapper'	BC3	748	8	19	26
	BC4	2119			
Musick'	BC1	73	4	1	8
	BC2	638			

Table 2: Holdings of the Maryland Chapter by Source of Resistance as of October, 2008.

There are now a dozen orchard sites in seven counties and various smaller educational plantings across the state. As is true in other state chapters, successful tree growing partnerships are the essential fabric of the Maryland's breeding program. MD-TACF partners include three different chapters of the Izaak Walton League, two private landowners, a family foundation and land trust, the University of Maryland, 4H clubs, public schools, outdoor education centers and the Washington Suburban Sanitary Commission—a corporation which provides drinking water in the Washington Metropolitan region. MD-TACF is fortunate to have good overall survivorship of the trees and high quality care provided on site in so many locations.

Pests

As mentioned later in the Southern Regional report, the Asian ambrosia beetle can be a significant threat to chestnut orchards. In Maryland, the Dickey orchard near Baltimore, MD has been affected by this insect for at least two years. Control methods will be implemented in 2009 in an effort to reduce mortality. Hopes are that positive results can be reported in next year's Regional report.

Hypovirulence

Hypovirulence continues to be topic of special interest to the Maryland chapter as well. Individual large surviving trees and many small ones in the Sugarloaf Westfield were treated with a soup of hypovirulent blight cultures over the summer. We hope these treatments will serve well to preserve regional diversity in the genus *Castanea* for continued scientific use, and look forward to follow-up reports from chapter members on the success of these treatments in the long term.

Virginia

In 2008, the Virginia chapter planted its first native backcross lines, derived from a selection of surviving American specimens, at two new orchard sites. One planting was at the Mount Zion Church Preservation Association in southern Loudoun County, an ideal partner with which to grow backcross chestnuts generated by pollinations on nearby mother trees in 2007. The historic church is a well-known local landmark to many familiar with the area (Figure 14). The second new orchard is on the Roland Farm, near the town of The Plains in Fauquier County a very scenic area of the Blue Ridge near Bull Run Mountain. Both sites will be filled to capacity with Spring 2009 plantings.

Figure 14: Mount Zion Church is an important historical site which has plantings of backcross chestnuts on its nearby conservation lands in Gilbert's Corner, VA. Photo courtesy Robert Strasser.

The chapter also completed controlled pollinations on more than a dozen trees in the same areas in the northern and northwestern parts of the state over the summer. The harvest in Virginia during 2008 included over 800 B_3 and B_4 nuts, bringing the chapter halfway to the goal of incorporating 20 regionally adapted American mother trees. There are now enough nuts from these 'Graves' and 'Mahogany' sources in cold storage to expand the VA-TACF holdings in 2009 to well over one-thousand trees from selected Meadowview fathers. Two to four new orchards will be added to the chapter network to accommodate the 2008 harvests.

Other notes of interest for the Virginia chapter include tree planting ceremonies at Stratford Hall, the childhood home of Robert E. Lee, and the opening of a Virginia chapter office in the town of Marshall. Situated in close proximity to growing partners in several counties and close to many trees in the chapter database, the new office will serve as a central geographic location for chestnut restoration and educational activities.

West Virginia

West Virginia will remember this as the year it attained provisional chapter status, adding the last large geographic area of mountainous terrain in central Appalachia to TACF's constellation of state chapters. A short working list of potential mother and father trees is a prelude to a breeding program which can extend the efforts of incorporating regionally adapted material into the backcross breeding program in the years ahead. Sites are already under consideration for setting up chestnut orchards in several locations representative of four regions within the Mountain State.

A few plantings are already scattered around the state, including an advanced hybrid planting on the Monongahela National Forest and a research planting in Morgantown, developed in association with Dr. Bill MacDonald and Mark Double at West Virginia University. Another research planting has been established in Boone County as part of TACF's work with the ARRI and OSM, as described in the Northern Appalachian Regional Science Coordinators report in association with plantings in Pennsylvania.

Southern Appalachian Regional Science Report

Dr. Paul H. Sisco, TACF Regional Science Coordinator, Asheville, NC **(now retired)**

Father Tree Program: Year Two

This summer volunteers from the Southern Chapters were again able to bring pollen from their hard-to-access American chestnut trees to Meadowview. Cooperation among chapters was excellent. Alabama, the Carolinas, Georgia, Kentucky and Tennessee chapters were all represented.

Southern Regional Meeting

Because of a conflict with the special TACF chapter meeting in Virginia called by Chairman of the Board Richard Will, we decided not to have a Southern Regional

Meeting in February, 2008. We did have the meeting in March, 2009. These region-wide meetings have been very useful in sharing information and addressing the scientific problems particular to the South: chestnut/chinkapin introgression, and pests and pathogens such as *Phytophthora cinnamomi* and the Asian Ambrosia beetle.

Cody Luedtke of the CC-TACF, David Morris of AL-TACF, and Scott Seagle and Hill Craddock TN-TACF pollinated Meadowview Research Farms tree BE50 to make seed for GA-TACF, an example of the cooperative spirit that made our summer work more efficient.

Southern Pests and Pathogens: Breeding for Resistance to *Phytophthora cinnamomi*

Joe James of CC-TACF and Steve Jeffers, *Phytophthora* expert from Clemson University, continued their multi-year experiment to determine which TACF backcross families have resistance to *Phytophthora cinnamomi*, an organism that can destroy the root systems of American chestnut trees. In the summer of 2008, Joe expanded to 14 tubs. Surviving seedlings selected from the 2007 experiment were transplanted into pots that were kept irrigated during the summer. About 70% of those died during the summer of 2008. Those that survived the second year after inoculation were transplanted into orchards on Joe's farm. In December, 2008, ratings of each seedling in the experiment were done by Joe James, Steve Jeffers, a group of Dr. Jeffers' postdoctoral associates, along with Steve Barilovits III and IV and Dr. Fred Hebard, who drove down from Meadowview Research Farms.

Southern Pests and Pathogens: Phosphites to protect seedlings against *Phytophthora cinnamomi*

Steve Barilovits III of CC-TACF conducted a backyard experiment this summer to test the efficacy of various phosphite products to protect first-year chestnut seedlings against *Phytophthora cinnamomi*. Steve experimented with Aliette –WDG (aluminum phosphite), Agri-Fos (potassium phosphite), and Prudent-44 (urea phosphite). His first-year results were that both Agri-Fos and Prudent-44 provided a good level of protection, but that Aliette, at the rate he applied, was relatively ineffective. He is going to repeat the experiment next summer.

Seven replications of the Phytophthora *experiment were planted at Joe James' farm in March, 2008, one replication per tub. Colored stakes delineated families of chestnuts, while the strings delineated individual rows. Joe James looks over the planting notes taken by Inga McLaughlin, while Steve Jeffers and Jae-soon Hwang work in the background. Photo courtesy of Paul Sisco.*

Potted American chestnut seedlings after inoculation with Phytophthora cinnamomi *in Steve Barilovits' backyard in Charlotte, NC. Untreated controls in the foreground are dying or dead. Seedlings sprayed with phosphite products are still alive in the middle. Photo courtesy of Steve Barilovits III.*

Southern Pests and Pathogens: Asian Ambrosia beetle attacks chestnut trees

The Asian Ambrosia beetle, *Xylosandrus crassiusculus*, was first found on peach trees in Charleston, SC, in 1974. The beetle has a wide host range and causes damage by introducing pathogenic fungi into the interior of the stem. It has attacked and caused death of both Chinese and hybrid chestnut trees in several of our orchards in the South, as well as in orchards of the American Chestnut Cooperator's Foundation (ACCF).

Evidence for natural crossing between American chestnut, Allegheny, and Ozark chinkapins

With the help of grants from The American Chestnut Foundation, both Fenny Dane at Auburn University and Joey Shaw, Hill Craddock, and their student Meagan Binkley at the University of Tennessee at Chattanooga have been studying the genetic diversity of American chestnut, Allegheny chinkapin, and Ozark chinkapin. It is clear from their studies that chestnut and chinkapin have interbred in the past, producing hybrid offspring. It is also clear that there is much more genetic diversity, at least in chloroplast type, in Allegheny chinkapins than there is in American chestnut.

Drought was again a problem
although over a smaller area than last year

Drought in the southeast was confined to a smaller area than last year. Extreme drought impacted northwest South Carolina, northeast Georgia, and western North Carolina.

In June, Floyd and Victoria Willis pollinate a tree at the Meadowview Research Farms. Photo courtesy of Paul Sisco.

Professor Joe Schibig received an award from the Daughters of the American Revolution for his studies of chestnut ecology in Tennessee and Kentucky. Photo courtesy of Joe Schibig.

David Morris (on right) spent a week working at Meadowview to help and Lee Gragg of the Carolinas Chapter (left) came up for a day. Photo courtesy of Paul Sisco.

Kentucky

Plantings continue on different types of reclaimed surface-mined soils as well as state and private forest lands. Victoria Willis has taken over as breeding coordinator, now that Michael French has a full-time job planting trees on reclaimed mine land. Several chapter members volunteered to drive to Meadowview for the Father Tree pollinations. Work is underway to get all chapter orchard records into TACF's national database.

Tennessee

The chapter is now producing thousands of seed and is struggling to find places to plant them all. TN-TACF acted as host for our national meeting in Chattanooga this past October. Chapter members manned booths at several local fairs and events. Joe Schibig won a DAR award for his work with chestnut. Meagan Binkley, student with Joey Shaw and Hill Craddock at UT-Chattanooga, completed her TACF-funded project on DNA variation in chestnut and chinkapin. Bethany Baxter, another student at UTC, completed interviews for an oral history project, also funded in part by a grant from TACF. The annual chapter meeting was held at the Ijams Center in Knoxville.

Alabama

The Father Tree Program has proved invaluable for the Alabama chapter, since AL-TACF has few flowering mother trees and most of them are producing only pollen. The chapter is negotiating with TVA (Tennessee Valley Authority) and adjacent municipalities to try to preserve the main chapter orchard on TVA land in Muscle Shoals.

Georgia

GA-TACF hosted the beginning of the 2008 Appalachian Trail chestnut hike in early March. Berry College installed an irrigation system in the college orchard. Mary Belle Price provided funds for a chapter intern. The GA Father Tree pollinations at Meadowview were a success, with several chapter volunteers making the long drive to southwest Virginia in June.

Mary Belle Price passes the chestnut baton to Tom and Mary Pachinger as the 2008 chestnut Appalachian Trail hike begins on Georgia's Springer Mountain. Photo courtesy of Carolyn Hill.

Carolinas

The chapter has completed 20 'Clapper' lines using high-altitude trees (>3500' elevation). The next chapter project, started this summer, is to use pollen from lower-altitude trees in the father tree program. These families will be screened for *Phytophthora* resistance before planting in an effort to create a population that is resistant to both *Phytophthora* root rot disease and blight. In June 100 trees in the orchard of Louis Acker and Allie Funk were inoculated with blight. Dr. Fred Hebard drove down on a snowy November day to evaluate the resistance ratings.

Matt Summerlin, 2008 Price Intern at Berry College, pollinates a tree at Meadowview.