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IN MEMORY OF: *A TRIBUTE TO DR. NORMAN BORLAUG (1914-2009)*

by
Donald Willeke, Esq.,
General Counsel for TACF

Nobel Peace Prize winner Dr. Norman Borlaug made great contributions to world agriculture and is often credited with saving millions of people around the world from hunger and starvation by working to produce a high-yield, high-quality grain for planting.

Few know that Dr. Borlaug was very instrumental in starting the effort to revive the most important tree of North America, the American chestnut.

The American chestnut was the most plentiful hardwood tree and by most accounts the largest single source of biomass in the United States. The trees grew 120 ft. and more, and reached over 8 ft. in diameter. Because they bloom in late June, long after the last frost has covered the ground, the American chestnut was able to reliably produce great quantities of the starchy nut year after year. Dr. Borlaug called the chestnut "the grain that grows on trees" and wildlife and humans thrived on the sweet fruit of the tree.

The American chestnut grew from Canada to Georgia and from the East coast to the Ohio River Valley and accounted for about 25% of all of the hardwood trees in its range. Its wood was as rot-resistant as redwood.

It was decimated by a fungus—chestnut blight—introduced from China on Chinese chestnut trees that were largely resistant to the blight. The American chestnut's loss was the greatest ecological disaster to strike the North American continent in the 20th century. Because it occurred over the course of 50 years, the blight's impact is often not recognized as such a disaster.

Dr. Borlaug was trained as a forester as an undergraduate. In the late 1970s, Dr. Borlaug was talking with his professor in plant breeding, Dr. Charles Burnham of the University of Minnesota, one of the people who helped develop hybrid corn in the 1920s. They both agreed that the U.S.

Department of Agriculture's failed effort in the 1920s to revive the American chestnut was "done all wrong" according to their knowledge of plant breeding.

Dr. Borlaug said that there was no reason that the same plant breeding techniques he and Dr. Burnham used on grains should not work on another plant such as the American chestnut. Working with graduate student Philip Rutter, they developed a plan to use their backcross plant breeding technique to introduce genes for blight resistance from the Chinese trees into American trees and to recover the much larger form, height and cold resistance of the American tree. They enlisted other University of Minnesota-trained scientists in their effort, including Dr. David French, Dr. Ron Phillips, Dr. Al Ellingboe.

As Chair of Minnesota's Urban Forest Council and a friend of some of these scientists, I was the first non-scientist to participate in the discussions about restoring the American chestnut. I helped establish The American Chestnut Foundation in 1983, and had the honor of spending time with Dr. Borlaug, which to me was fully the equivalent of knowing Thomas A. Edison or Thomas Jefferson. Dr. Borlaug was an original Director of TACF, and remained an Honorary Director of the Foundation all his life.

Now, 26 years later, Dr. Borlaug's genius is bearing fruit. The Foundation he helped establish has four major research farms and many thousands of advanced backcrossed trees that are highly resistant to blight. We are already establishing seed orchards where the most resistant, nearly pure American chestnut trees will intercross with each other and produce millions of seeds to be used in our future restoration efforts.

I can pay no higher tribute to Dr. Borlaug than to say that of all the people I have ever met, he most meets the impossible standards set by the first verses of the First Psalm:

Blessed is the man that walketh not in the counsel of the ungodly
Nor standeth in the way of sinners,
Nor sitteth in the seat of the scornful, but his delight is in the law of the Lord,
and in His law doth he meditate day and night.
He shall be like a tree planted by the rivers of water, that bringeth forth fruit in his season
His leaf shall not wither,
And whatsoever he doeth shall prosper.

Dr. Borlaug: What you have done shall prosper—far, far, far more than most people know.

From the Editor

This issue of the Journal is dedicated to a gentleman whose work had a tremendous impact on the world. Dr. Norman Borlaug was a longtime friend of TACF and we mourn his passing this past summer at the age of 95. Dr. Borlaug took a personal interest in TACF and his encouragement played a key role in the success of the Foundation. Here's to you Dr. Borlaug.

We have quite a compilation of memories, scientific results and of course, a year-end report from our Meadowview Research Farms.

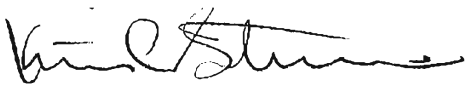
TACF member Dr. William Wood shares his well-spun and memorable tale of the "*Great Chestnut Ghost*" of his childhood. This story is a must read for any chestnut enthusiast.

Former Alabama Chapter president Dr. Larry Brasher uses his journalistic skills as he transcribes the memory of Daniel Hallett, one of a handful of survivors who remembers the initial blight attack on chestnuts near New York City.

Researchers from the University of Kentucky teamed with Drs. Bob Paris and Fred Hebard to discuss, "*The Use of Tree Shelters to Deter Predation of American Chestnut Seed on Reclaimed Mine Lands*."

Also in the 'From Then to Now' section find out what happened during 2008-2009 at Meadowview Research Farms 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.

While this is the final issue of the Journal in this format, we can all look forward to more scientific information in TACF's new magazine later this year.



Dr. Kim Steiner
Vice Chair, Science Cabinet
The American Chestnut Foundation

Memories

THE LAST CHESTNUT GHOST

A story based upon my childhood experiences in western North Carolina

by William B. Wood, MD, Chapel Hill, NC

I was born in February, 1931 in the northwest corner of North Carolina in Surry County. It was close enough to Wilkes County to "smell the corn mash," and about ten miles below the Virginia line. This is the western-most foothills where the South Fork of the Mitchell River flows out of the hillsides, slopes, and glades and passes within one-hundred feet of our home, nestled in a back cove. It was here that I was privileged to spend ten years of my childhood playing in the cool, swift stream and roaming the pastures and hillsides in a carefree manner that, even now, surprises me. That freedom was my great learning experience. My father was a largely self-taught school teacher and farmer who encouraged observation and the asking of questions. But, surely, the most puzzling and enchanting questions concerned the great grey ghost chestnut trees that stood majestically above the otherwise viable forest, commanding their space in stark contrast to the foliage around them.

There was no doubt these gigantic chestnuts had been the monarchs of the forest. The stories told by my parents, family and friends fostered curiosity, admiration and sadness in me. How could such majestic trees, which provided abundant food for people and animals, provided timber for homes and furniture, and income for poor farmers, disappear? The mystery was intensified by descriptions of the blanket of snowy white blooms covering the mountainside and the happy times spent gathering chestnuts told by my mother and father, grandparents, and others--as much as 10 to 20 bushels in a few days when the chestnuts fell from their lofty heights with the opening of their sharp, spiny burs.

It was an urgent and exciting task to gather as much as possible before feral pigs, black bears and other plentiful forest animals consumed or spoiled them. True, the chestnuts might lie for the winter months protected by their leafy bed, but they might spoil or begin to sprout; so collection, storage and preparation for many food dishes was the order of the day. Parties were organized to lighten the task and spawn competition. To a young boy at the time it seemed all the fun of collecting chestnuts had been missed by "being born too late."

Even with this disappointment, the deepest sadness was the haunting presence of these great towering chestnut ghosts. There were a few small struggling trees tucked in back coves when I was a child. These finds always produced excited talk about regeneration. Grandfather would, animatedly, revive his vision of re-establishing the great forest giants. However, just as everyone knew they would, these small fugitives from the death sentence were soon found by the chestnut blight and were quickly dispatched.

There was a truly gigantic chestnut ghost several hundred yards beyond our home, standing defiantly near the bottomland field and the bank of the river. It was magnificent even in its barren death—larger than several men could reach to encircle its girth, obviously more in diameter than a tall man, at least seven to eight feet at the butt stump. The height imposed itself over the other tall trees and cast a shadow over the landscape, the last dark image to disappear from the open bottomland as the sun sought refuge beyond the forested mountainside. I often sat in a curious and admiring gaze as I visually traced each limb, now pruned of peripheral branches and foliage. I wondered how it would feel to be grandly sitting there, to see and be seen by all the world. Climbing such a tree would be impossible—much lesser ones were a daunting challenge to an eight-year-old boy—but if I could just fly, I know where I would be!

I know my father admired this old patriarchal tree. I suppose that is the reason he had never felled the tree in the nearly twenty years since its death, even though dozens of others had been harvested for use on the farm and sold for much needed income, for these were the harshest of the Depression years in the mountains of North Carolina. Farm goods had virtually no market and tobacco sales failed to provide sufficient funds to pay for the fertilizer and the costs of transporting it to Winston-Salem to sell. Our apple orchard was prolific but apples had no market or so little, even at twenty-five cents per bushel, that orchard upkeep could not be maintained. We gave away much more to family and friends than we sold. Therefore, all sources of income had to be pursued. This eventually meant doom for the "Last Great Chestnut Ghost."

My father, mother and resident Uncle Fred developed a plan for the felling of this huge tree. It would have to be done in several staged encircling cuts to allow the use of the cross-cut saw, the longest of which was a mere six feet. The limited length would give only about one foot of "swing" to the saw stroke. This would add greatly to both the time needed and to the anticipated danger. Multiple assault directions would be used to encircle the massive butt with saw and notched axe cuts. Fortunately there was no tilt or leaning, and the few remaining limbs were about evenly spaced. The determining factor in the "fall" would be placement of the cuts, making higher ones on the far side. The softness of the plowed field would offer some cushioning as it struck the ground--perhaps preventing damaging splits and breaks.

Multiple sized gluts were prepared, long straight poles located, new mauls hewn, two-man crosscut saws sharpened and axes ground on the water wheel until the beveled edges sparkled. All was ready—we would get an early start in the morning, this was no job to rush. The schedule was to have the tree worked up by the first of the next week since it was so dry it would soak up water. Besides, it was the fall of the year and heavy rains might send the South Fork River out of its banks, sweeping the timber away. This great harvest would supplement our very meager farm income. My father had stopped teaching in order to fill in for the extra time needed for farm work—we couldn't afford hired labor anymore. Maybe he could save the farm and our home from mortgage foreclosure. The bank at Elkin had already had a serious discussion with him,

making me as anxious as my parents, though I could not grasp the full impact of foreclosure. I only knew there was increased talk of having to leave my beloved mountainside, creek, pastures and fields where Indian artifacts could be found. It was my whole world. But would it be the same to me and to Dad with this last Chestnut Ghost gone?

My sleep that night was troubled. The excitement about the preparation for the unknown events the next day kept me awake. There was tension reflected in my father and uncle as well as an impending sense of loss. Still, selling chestnut timber for lumber and the promised purchase of split rails at a premium price just might tide us over and save the farm for better times next year—always the farmer's dream. Sleep finally came. Dawn arrived as my mother gently touched my face and inquired, "Billy, do you want to join your father in felling the tree?"

The fall morning light spilled across the tops of the hillside on the far side of Mitchell South Fork—golden, yet pink with sparkling reflections of moisture on the leaves—not yet cold enough for frost but clear and crisp with dew and fog from the small river. Uncertain at first, I was suddenly wide awake. Dad and my brothers were still eating a hearty breakfast of biscuits with ham and red-eye gravy, and stewed apples and they seemed to be lingering a bit later than they had planned, almost as though there was a reluctance to get on with the task at hand. There may have been an unwillingness to face the potential dangers of such a large challenge, or perhaps it was a hesitation to carry out an act that would change a relationship between a man and his farm? Dad said, "You don't have to come with us if you don't want to. It will be a long time before we are ready for the chestnut to fall." I felt like saying, 'I hope it will take forever,' yet I nervously anticipated the big event. Surely, this was the most impressive thing I would ever see...an eight-year-old boy's sense of time is very truncated.

Bett, the mule, was already fed and ready to be backed between the shaves of the one-horse wagon and the equipment to be loaded. My mother reminded me to stay far out of the way of the tree. I tried to stay busy gathering expelled chips flung from busy axe blows and small limbs scattered about. This would be another unhappy change; another loss. Even more, the felling of the Chestnut Ghost would now leave another empty place never to be filled again.

The tone of Dad's voice and Uncle Fred's eternal bantering reassured me that this was best for family and farm, maybe our only hope. "Billy, you go with [your brother] Pete to take Bett back to the barn, no need to leave her standing." I could do it by myself but older brothers get the responsible jobs. Brother Tom was assigned to keep the tools in order. Reluctantly, I helped put Bett into the pasture, then ran back to my sentry post. By this time our family friends "Uncle" Zed and Theodore McCann had arrived to keep a neighborly watch, but not necessarily to do any work except to offer "considered" advice.

Was the center of the tree hollow even though it appeared and sounded solid? Each blow made

me flinch as though I could feel the strike as the "thunk" echoed off the opposite hillside. No, it did not seem to be hollow and the wind would not be a great problem since there were no leaves to catch the force. Zinging saw strokes, sharp and deep axe blows produced large airborne chips; sweating, heavy breathing effort—with each axe blow a forcefully expelled breath sighed—with each swing, several wide notches cut deeply into the mighty tree. It was much harder cutting into the awkward angle than initially thought and the notch had to be widened several times, slowing the progress considerably.

By mid-morning, Dad and Uncle Fred had the front and both sides hewn away with the side cuts angling up toward the back where a higher final cut would be made. Was there any sign of unstable movement—had any tilt been detected? Prolonged moments of plumb lines held aloft, assisted by distant 'eyeballing' through squinted eyes by otherwise non-helpful neighbors confirmed that the situation remained stable.

"I tell you, folks, seems like you will never get a cut through, not before Christmas," laughed Zed.

Late morning showed the rich, reddish-brown heart had been breached and Dad felt it was time to take a break from what had been an unexpectedly difficult job. So they would see if Mom could provide a little early mid-day dinner and rest, allowing them to finish in early afternoon after some unsupervised planning.

A rest and good food brought agreement on the final act and we returned to the site. With axes and saws re-sharpened the remaining cuts seemed to move more quickly. Gluts and pike poles, though applied generously, never outnumbered the anxious looks and re-sightings to detect the earliest indication of the fall direction. Finally, Zed called out, "She's beginnin' to lean just a mite."

"Whicha' way man,? I want to get my butt out of here when she starts," called back Uncle Fred.

With the observation confirmed, gluts were more forcefully driven and poles set as the saw was paced to more rapid movement. Each man eyed his direction of retreat and with a few more strokes of the saw, a loud "POP" and creaking signaled the fatal loss of balance as a slow, graceful arc of movement became an accelerated "SWOOSH" and a ground-shaking thud as a few limbs hurled back into the air. Without a quiver or final gasp the mighty bulk seemed to blanket the bottomland field—the butt end taller than a man's head. No great cheer of a task accomplished sounded, only shifting looks directed to the mighty Chestnut Ghost, then toward one another, mixtures of lifted anxiety, near disbelief, and a bit of sadness.

Several moments passed with no spoken word. I decided I would go back to the house for a

while—just to let Mom know that everything was all right—she would be worried.

We spent several days cutting and splitting the wood into manageable quarters to be hauled for milling into quarter-sawn boards. We also determined what parts could best be used for split-rails. I dreamed of the rhythm of cross-cutting, the ring of steel against steel followed by mauls driving gluts and the ripping of long straight wood grains pulling apart into rails. Within a week the millable quarters were moved by wagon to trucks, and rails were stacked into accessible ricks to be picked up. Anticipation of a generous financial return assured much income and a sizable mortgage payment--the farm would be saved, at least for another year.

But times were hard in the mountains and foothill towns in the late 1930s. The furniture plant that had contracted for the chestnut lumber went bust and we ended up receiving less than ten percent of the anticipated price.

The builder of the fine house with split-rail fences simply disappeared with the project half finished. We would not be able to sell our wood to him. We could, perhaps, use some of the rails to repair our own fences, but the chestnut lumber was gone into the Great Depression sinkhole which was making itself felt more belatedly and severely in the mountains than in some other regions. The last Chestnut Ghost had made its final and futile gift in vain. We would not be able to save the farm.

Characteristic of families that depended on the land and weather, my father labored on the farm for another year with a temporary reprieve from the bank. One of the bank officials accepted a large quantity of split rails as payment as well as expectations of a better price for tobacco and apples next year. Our struggle was made worse by the death of our elderly mule. Bett was the younger mule but could not carry the full load of the farm work and there was no money to purchase a replacement for Joe. That following year we left our mountain home and the South Fork of the Mitchell River behind and moved to the Piedmont area. We began a new life but my heart and my love remained in that mountain valley, with the sweet freedom of the pastures and orchards, and the swift stream and hillsides.

Only one big question remained: Have I manifested even a small part of the strength and generosity and sacrifice of that 'Last Great Chestnut Ghost?'

From the true life experiences of the family of "Professor" Posey Day Wood, a sometimes teacher and farmer and full-time father and husband, as recalled and lovingly recounted by William Bainster Wood, Sr., M.D., Chapel Hill, N.C.

SURVIVORS: AN INTERVIEW WITH DANIEL HALLETT

Transcribed by Dr. Lawrence Brasher, Alabama Chapter of TACF

Born September 11, 1911, Daniel Hallett is one of a handful of survivors who remembers the initial attack on chestnuts near New York City in 1904. He still lives on the farm where he was born, and where he gathered chestnuts as a child, near Stillwater, New Jersey. And at age 98, he still cuts, splits, and stacks the wood that heats his home all winter. The following is a transcription of a sound recording of Danny Hallett made in June 2008.

"I remember when I was about five there were still some live American chestnuts. In the summertime we used to go barefoot and sometimes step on those husks by accident. Jeez! They were all in the fence lines, not out in the fields. They were on everybody's place, plenty of them. And in the fall when the burs would drop off, it would take a good frost to open up those husks, and then you could get the nuts. They were good eating. We liked to roast them.

Figure 1: Daniel Hallett (right) in front of his woodpile with niece Louise Tharaud and great nephew Daniel Brasher.

The chestnut trees where we got the nuts were across from the Mount Pleasant schoolhouse, on our farm. A dozen or so great big spreading ones in the fence line. And they were the last ones I remember being alive when I started school at age five. I think I went to school for two days, and then I got sent home. I had to wait until I was six. They didn't have kindergarten yet. Mother, I guess, was probably more disappointed than I was. There were other nut trees in the fence lines too –hickory nuts and walnuts. We used to gather them. I hated those walnuts because they stained you. This area where my house is was not in a pasture; it was in woods. There were big chestnuts in the woods, but they weren't

Figure 2: Mount Pleasant School, about fifteen years before Daniel Hallett was a student.

Figure 3: The nearby largest American chestnut tree in northern New Jersey.

Figure 4: The remains of a tree from which Daniel Hallett gathered chestnuts 93 years ago. Larry Brasher next to it.

too tall. You couldn't get more than one good log without getting knots.

Then after the trees had been dead a few years folks used to take them down to Grandfather's sawmill and he'd cut them into boards or whatever you wanted. Some of the logs were over three-feet thick. I remember we used them for putting a ceiling in above the milking cows in the barn. We had inspectors from Jersey City–that's where the milk went–Dairymen's League inspectors. They were always leaving a list of what you had to do–get everything sealed up and whitewashed! So we whitewashed the chestnut ceiling. Some of the boards were over a foot wide.

Chestnut was a good wood to work–to saw and plane–and long-lasting. We used it to trim a lot of houses–doors, windows, chair rails. Grandfather's sawmill was right across from where the barn is. Grandfather was a farmer. He had a lot of sheep and he grew corn, oats, rye, and hay, and raised berries and fruit –raspberries (red and black), strawberries, gooseberries, currants. He would take them to Newton to sell. The sawmill was steam powered and wood fired. We got the water out of the brook and used the slabs that were sawed off the logs. The brook crossed right under the road there, and there was a watering trough. Everybody watered their horses when they were coming home from town. That barn was built when I was four or five. That's when they were sawing up all the dead chestnuts, and I wouldn't doubt that they used some of them for that barn.

Grandfather had another sawmill back over in an area known as The Glen that had a turbine down in the pit. A 12-inch pipe came from the dam into the housing that ran that turbine.

The turbine had a shaft that came up from it and a pulley on it ran the sawmill. There was also a circular saw that could take a three-foot-thick log and even bigger. Grandfather had quite a long beard and he'd stand up there pulling the levers, and the wind from that saw whirling would part his beard. Grandfather had a little pushcart. It ran on rails, and had four wheels, and just three or four sticks to pile the lumber on. My sister Serena and I used to take the sawed lumber out and play on that. I remember one time we got it off of the track!

Those trees, after they died, were standing out in the woods for years. Longevity. Everybody used them for split rail fences in the old days before the trees died. On the next farm over, Uzal Crouse had a big lumber wagon, six wheels, four or five horses on it. He took logs to Grandfather's mill. He also used to carry mine props and railroad ties–probably some were chestnut–and take them to the railroad, either in Blairstown or Stillwater. The Blairstown loads went to the freight station on the Lackawanna cutoff. Stillwater was on the Susquehanna line.

There was a chestnut tree several years ago that grew up in these woods again, got to be ten inches in diameter, but it was tall–gee! And it didn't have many branches on it, only way up at the top, certainly forty-feet tall. It died not too long ago, and I cut it for firewood. I've burned it all, I think. I guess everybody was sorry when the chestnut trees got sick. Everybody loved the chestnut.

The weathered skeletons of the very same trees from which Daniel Hallett gathered chestnuts 93 years ago still lie in the fence line across from where the Mount Pleasant School stood. But others survive nearby. Within a mile of Danny Hallett's home on his niece's property lives the largest known American chestnut in northern New Jersey (eight inches in diameter and 60-feet tall) with flowers in the summer of 2009.

Science and Natural History

Use of Tree Shelters to Deter Predation of American Chestnut Seed on Reclaimed Mine Lands

by

Dr. Jarrod O. Miller, Department of Forestry, University of Kentucky; Dr. Christopher D. Barton, Department of Forestry, University of Kentucky; Dr. Robert L. Paris, TACF; Dr. Frederick V. Hebard, TACF

Introduction

The reforestation of lands disturbed by surface mining in the Southern Appalachians originally focused on land stability and erosion control rather than hardwood species recovery or timber value (Rodrigue and Burger, 2004). Past reclamation efforts used woody species such as black locust (*Robinia pseudoacacia*), green ash (*Fraxinus profunda*), and autumn olive (*Elaeagnus umbellata*) which grew sufficiently on these disturbed lands, but were not valued for timber production (Jacobs et al., 2005; Rathfon et al., 2004). The seeding of blight-resistant chestnuts on reclaimed mine lands is an alternative to these less desirable species and provides us additional opportunities to examine site requirements for blight-resistant chestnut release (Jacobs et al., 2005; Hebard, 2005; French et al., 2007a).

Currently, the Forestry Reclamation Approach (FRA) promotes the use of loose-dumped mine spoils which creates conditions suitable for native hardwoods and chestnut establishment, including low vegetative competition, soil properties similar to Appalachian ridgetop soils, and a lower probability of *Phytophthora* sp. presence (French et al., 2007a). The American chestnut is competitive on these mine lands because it is already adapted to a wide range of conditions in the southeast and has a fast growth rate (Jacobs et al., 2005; Jacobs and Severeid, 2004). In addition, the Appalachian coal region falls almost entirely within the natural distribution range of American chestnut (French et al., 2007a).

Recent research has shown high survivorship (80%) of transplanted chestnuts on reclaimed lands after one growing season (Jacobs et al., 2005; French et al., 2007b). Although promising, direct seeding of chestnuts may be preferred over transplantation methods due to costs associated with developing transplantation stock and potential *Phytophthora* sp. contamination in nursery beds; however, rodent predation of planted nuts may be problematic on mine lands (French et al., 2007b). A recent study found that rodents prefer the micro-topography and habitat of loose-dumped reclaimed areas over those reclaimed using traditional reclamation methods (Larkin et al., 2008). Use of tree shelters may reduce seed predation by rats, mice, and deer and has shown increased seedling survival and growth in several studies (West et al., 1999; Strange and Shea, 1998; Conner et al., 2000; Dubois et al., 2000). Given that chestnuts are a favorite forage of wildlife (Steele et al., 2005), a study was undertaken to evaluate the effectiveness of tree shelters for preventing chestnut predation on loose-dumped mine spoils.

Materials and Methods

Study Site

Since late 2003, the University of Kentucky has been engaged in the on-going installation of a reforestation research complex on an active mountaintop removal operation located on Bent Mountain on Brushy Fork. This is near the community of Meta in Pike County, Kentucky (latitude N 37° 35′ 49″, longitude W 82° 24′ 19″) (Figure 1). The mine is located in Kentucky's eastern coalfield in the Cumberland Plateau physiographic region.

Figure 1. Aerial photograph of the surface mine and reforestation research complex at Bent Mountain in Pike County, Kentucky taken in October 2007.

Spoil Placement and Planting

Brown weathered sandstone spoil was dumped out of the end of dump trucks ("loose-dumped") into piles that average about 3.5-meters in height and placed in parallel rows so that they closely abutted one another across a 1.5-hectare site. The tops of the spoil piles were "struck-off" with one pass of a bulldozer (Caterpillar D9, straight blade) down the length of each parallel ridge of spoil, pushing it into the parallel valleys on both sides.

In April 2008, 30 plots were established on the end-dumped site at Bent Mountain, 10 x 10-meters in size and containing 25 planted chestnuts. The five chestnut genotypes used in the study were: American, Chinese, B_1F_3, B_2F_3, and B_3F_2. Each species was examined with and without the use of tree shelters. Treatments were randomly assigned to a plot location and replicated three times, so that 150 chestnuts were required for each genotype giving a total of 750 nuts for the study.

At each planting location a 10-centimeter deep hole was prepared using a dibble or shovel. A teabag of fertilizer (Treessentials®, Duluth, MN) was placed in the bottom of the hole and covered with 2-4 centimeters of planting mix (Scotts® general potting medium). Each chestnut was placed on the planting mix, roots down, and covered with an additional 2-4 centimeters of planting mix. Chestnuts on sheltered plots were protected with 60-cm Tubex® shelters that are anchored to the ground with white oak stakes, following the manufacturer's instructions.

Percent germination was measured in June, 2008 while chestnut height and survival were measured in September, 2008. Statistics were run on SAS™ as a completely randomized design structured by a factorial, with one main effect being genotype and the other main effect being the use of shelters. Least square means and slicing were used to determine if there were differences among genotypes within sheltered or unsheltered plots.

RESULTS

Germination was calculated as the percentage of seeds which sprouted, and ranged from 77-84% for all five genotypes when sheltered and 1-12% when not sheltered (Table 1). There were no main effects of genotype for germination percentage, but there was a significant shelter effect (Table 1). A slice of the data by SAS™ revealed no genotype effects within sheltered or unsheltered chestnuts, but all five types had a significant shelter effect ($p = <0.0001$). Among unsheltered chestnuts the variation was always greater than the mean.

Survival was calculated as the percentage of chestnuts planted which had not died by the end of the growing season, including those which did not germinate (Table 1), and was lower for all genotypes when compared to germination. There was a significant shelter effect on all genotypes ($p<0.0001$), but no main effect across all chestnut types. Among sheltered trees the pure American chestnut had the lowest survival (54.7%), while all other types were similar (64.0 to 74.7%). Among plots where chestnuts were not sheltered, there were no differences among genotypes in survival rates, which ranged from 7-11%.

When height (centimeters) was measured, the differences between genotypes became clearer. Like germination and survival, there was a significant main effect of sheltering the trees, but no differences among all chestnuts type. Mean heights ranged from 32.9 to 51.3 centimeters among sheltered, and 0.4 to 3.3 centimeters among unsheltered chestnuts. When the data were sliced, there remained no differences among unsheltered genotypes ($p = 0.9853$), while Chinese, B_1F_3, and B_3F_2 grew more than the American and B_2F_3 genotypes ($p = 0.0161$).

Table 1: Mean height, percent germination, and percent survival of the five chestnut genotypes after one growing season. *

Genotypes	Germination %		Survival %		Height** (cm)	
	Shelter	No Shelter	Shelter	No Shelter	Shelter	No Shelter
	----------%----------				----------cm----------	
American	82.7 ± 10.1	12.0 ± 13.8	54.7^{b} ± 8.3	10.7 ± 11.5	32.9^{b} ± 33.3	3.3 ± 10.9
B_1F_3	77.3 ± 6.1	6.7 ± 8.3	69.3^{a} ± 6.1	5.3 ± 6.1	51.3^{a} ± 37.6	1.1 ± 6.1
B_2F_3	77.3 ± 15.1	1.3 ± 2.3	64.0^{a} ± 18.3	1.3 ± 2.3	38.1^{b} ± 32.9	0.4 ± 3.8
B_3F_2	84.0 ± 12.0	6.7 ± 2.3	65.3^{a} ± 2.3	4.0 ± 4.0	41.9^{ab} ± 33.6	0.4 ± 2.9
Chinese	78.6 ± 9.2	6.7 ± 11.5	74.7a ± 10.1	6.7 ± 11.5	50.1^{a} ± 33.7	1.8 ± 6.9

---------- P values ----------			
Genotype	0.6862	0.5383	0.1656
Shelter	0.0001	0.0001	0.0001
Interaction	0.9625	0.2461	0.1037

* Mean height, germination percent, survival percent ± standard deviation

** Least sig. differences ($\alpha = 0.05$) of sheltered species represented by superscripts.

Discussion

While all species have germination rates above 70% when sheltered, survival of both the American and B_3F_2 genotypes falls off by the end of the growing season. The pure American chestnut has the lowest height of all genotypes, while the pure Chinese chestnut has one of the highest survival percentages and average heights. The B_1F_3 genotype performs as well as the pure Chinese, and may prove to be a viable American variety in the future.

Small mammals are an important part of terrestrial ecosystems and drive a variety of ecosystem processes. Small mammals serve as prey for a variety of mammalian, avian, and reptilian predators (Mindell, 1978; Yearsley and Samuel, 1980). As such, their return to post-mining landscapes should be an important biodiversity consideration for reclamation. However, small mammals can also negatively modify plant community composition and species distribution through foraging and burrowing (Hole, 1981; Siege, 1988). Their roles as seed predators, herbivores, detritivores, and seed dispersers have been shown to affect plant distribution and succession on surface mine lands (Chamblin, 2002). Bramble and Sharp (1949) observed seed predation by white-footed mice *(Peromyscus leucopus)* causing failed northern red oak (*Quercus rubra*) establishment on Pennsylvania surface mines. More recently, a study showed that white-footed mice and other small mammals prefer loose-dumped reforested landscapes over those reclaimed using traditional approaches due to the abundance of crevices formed between large rocks (Larkin et al., 2008).

The benefits of shelters on our site were obvious, with shelters being significant for all chestnut types for germination, survival, and height. Nuts could not be found within many of the unsheltered holes, which supports the hypothesis that mice and other wildlife are foraging on the nuts (West et al., 1999; Strange and Shea, 1998; Conner et al., 2000; Dubois et al., 2000). Although the long-term viability of chestnuts on this site cannot be evaluated at this time, it is clear that the use of shelters is essential if direct seeding methods are to be utilized in future planting efforts.

Conclusion

The use of reclaimed surface mines for chestnut reestablishment has recently gained attention as the U.S. Office of Surface Mining Reclamation and Enforcement continues to promote the Forestry Reclamation Approach (FRA). Numerous reasons for planting chestnuts on fresh mine spoils have been presented and include: high survival and growth for native hardwoods on loose-dumped mine spoils, light and soil chemical characteristics that are similar to higher elevation and ridgetop positions where chestnuts were dominant, loose mine spoils are initially devoid of vegetative competition, and fresh mine spoils may initially be devoid of pathogenic microbial communities such as *Phytophthora*, which have hindered TACF's breeding and restoration efforts elsewhere. If loose mine spoils prove conducive to chestnut survival and growth, then the establishment and dispersal from founder populations of blight-resistant hybrids throughout the Appalachian coal region would aid TACF's goal of restoring the chestnut throughout its range. Initial results from this study show promise that loose-dump techniques may be suitable for various chestnut genotypes. However, restoration efforts via direct seeding will be futile without the use of shelters on these

sites as there is little chance of germination due to predation.

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From Then to Now

Meadowview Notes 2008-2009

by
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Meadowview experienced drought conditions in 2008 and into the start of 2009. However, there was enough rain during the 2008 growing season to make most crops. This second year of drought may have impaired chestnut production somewhat, and impaired growth of new seedlings on some soils.

Inventory

Our current holdings are presented in Table 1, and changes from 2008 to 2009 are indicated in Table 2. We now have more than 57,000 trees and planted nuts, an increase of almost 10,000 over last year (Table 2). Most of the increase is due to the addition of B_3-F_2 trees, which increased by 7,118. We also added 1,171 B_3-F_3 trees. Our holdings of other types are relatively constant, with new plantings offset by removals, as we have made selections and rogued the rejects. Next year the total number of B_3-F_2 trees should start to decline dramatically as we rogue reject trees and near the end of addition of new trees to our Clapper and Graves seed orchards. We did not rogue many trees this year because we were leaving them for histological studies, to be described below.

Harvest

This year, we continued our efforts to make backcross F_2 trees for sources of blight resistance other than Clapper and Graves. The general lack of success in these efforts can be found in the relevant rows of Table 3. We also tried to make test crosses back to Chinese and American chestnut and backcross F_2 trees for the Nanking source of resistance, and a few others. Some of these crosses were successful. We plan to assemble full sets with future crosses.

In 2008 we harvested more B_3-F_2 nuts from trees with the Graves source of resistance than the Clapper source. This was because we completed the planting of B_3-F_2 nuts for many lines from the Clapper source and did not harvest from their parents in 2008, whereas most Graves lines were still incomplete in 2008. With the planting of these B_3-F_2 Graves nuts in 2009, most lines from that source of resistance also are complete, with 1350 nuts planted per line.

We harvested 2,433 Clapper B_3-F_3 nuts in 2008, and additionally our first crop of Graves B_3-F_3 nuts, numbering 1,659. These enabled further planting in orchard and forest test sites, and more distribution of B_3-F_3 nuts and seedlings to TACF members.

Blight resistance screening in B_3F_3 seedlings

In 2008, we tested the blight resistance of B_3F_3 seedlings that were planted in 2006. These seedlings were from our first B_3F_3 harvest in 2005. Since there were only about 100 B_3F_3 seed harvested in 2005, from five separate mother trees, these had not been planted in a formal test with controls. It was only in 2009 that we planted a formal test of B_3F_3 progeny, once a sufficient number of seeds and seedlings had been accumulated to merit a formal test. The results of the preliminary test performed in 2008 are shown in Table 4, as well as canker size statistics from October measurements after inoculation in June. Blight cankers on these trees were small, with no trees with very large cankers. For informal comparison, similar statistics from a 1993 test are shown in Table 5. These results are encouraging, suggesting that the parent B_3F_2 trees were reasonably homozygous for blight resistance since the variation in canker sizes was small. A comparison of canker sizes between the B_3F_3 trees in Table 4 and the size of cankers on Chinese chestnut in Table 5 also suggest B_3F_2 blight resistance was comparable to Chinese chestnut. However, a formal statement of this conclusion will have to await the results of the formal test planted in 2008, which we expect in 2011. The tentativeness of this conclusion is also reinforced by the fact that most of the B_3F_3 sprouts died as a result of the inoculations (although many have resprouted). These deaths were not unexpected and occurred also in the 1993 test shown in Table 5, including the Chinese chestnut seedlings, as well as in other tests.

Components of blight resistance

There are a number of ways that our B_3F_3 trees might not end up with enough blight resistance or American characteristics to thrive in forested settings. Many of these will only be revealed when the trees are grown in the forest, but we might be able to determine before then whether or not our screen for blight resistance is failing to detect some components of blight resistance. Of particular interest to us has been sclerification of the phelloderm layer of wound periderm.

Wound periderm is the tissue trees develop to isolate cankered from uncankered portions of bark. Sclerification of phelloderm rigidifies the wound periderm, enabling an increase in stem diameter to slough off the cankered bark as the underlying tissues grow and expand. Wound phelloderm sclerifies most of the time in Chinese but not American chestnut. Sclerification begins in September or October after wounding and inoculation in June, yet our screen for blight resistance depends strongly on the rate of canker expansion during the summer and early fall.

Evaluation of backcross progeny for this trait has suggested we indeed are not selecting for it. Further tests are in progress to characterize progeny for the trait more thoroughly. These tests should enable us to decide whether it will be necessary to select for this trait.

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and inoculations. Special thanks to Dave Slack for volunteering one or two days a week all year round for the past four years! Also, we need to acknowledge the role of George Sykes, Danny Honaker, Darryl Caudell, Lori Hall, Louise Cottrell, Bobby Scarborough, Bob Wesche and many others who keep 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 and call (276) 944-4631. If you are interested in learning more about the Elder Hostel program which helps TACF inoculate American chestnuts each June, 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. Our offices will be moving to our newly-constructed laboratory in Meadowview sometime in late spring. For now, 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 2009, 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	1943		220
Chinese	505	56	
Chinese x American: F_1	453	20	82
American x (Chinese x American): B_1	669	14	28
American x [American x (Chinese x American)]: B_2	1921	12	67
American x {American x [American x (Chinese x American)]}: B_3	1910	10	81
Am x (Am x {Am x [Am x (Ch x Am)]}):B_4	509	3	6
(Ch x Am) x (Ch x Am): F_2	320	5	10
[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	837	7	12
{Am x [Am x (Ch x Am)]} x {Am x [Am x (Ch x Am)]}:B_2-F_2	245	6	12
(Am x {Am x [Am x (Ch x Am)]}) x (Am x {Am x [Am x (Ch x Am)]}):B_3-F_2	38358	2	48
B_3-F_3	1267	1	10
Chinese x (Chinese x American): Chinese B_1	183	4	4
Chinese x [American x (Chinese x American)]	126	3	8
Chinese x {American x [American x (Chinese x American)]}	294	5	16
Chinese x Chinese	2014	67	
Chinese x Japanese	109	2	
Chinese x European	140	1	
Chinese x Large, Surviving American	153	7	7
European	1	1	1
European x American F_1	2	1	1
Japanese	8	3	3
Japanese x American F_1	9	2	2
[(Japanese x American) x American] B1	10	2	2
{[(Japanese x American) x American] x American} B_2	134	1	1
Japanese x European	157	1	1
Japanese x Large, Surviving American	27	5	5

Castanea ozarkensis	30	1	2
Castanea pumila	39	2	2
Castanea seguina	48	3	3
Large Surviving American F_1	1109	19	50
Large Surviving American B_1	541	7	13
Large Surviving American B_2	169	3	4
Large Surviving American I_1	1893	31	32
Large Surviving American I_2	338	7	8
Large Surviving American I_3	88	1	1
Large Surviving American F_2	143	7	11
Large Surviving American F_3	320	1	1
Large Surviving American other	64	6	6
Other	61		
Total	57152		

* 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 is 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 2008 and 2009 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	-63		10
Chinese	-57		
Chinese x American: F_1	-22	61	3
American x (Chinese x American): B_1	147	14	-1
American x [American x (Chinese x American)]: B_2	177	56	24
American x {American x [American x (Chinese x American)]}: B_3	114	72	0
Am x (Am x {Am x [Am x (Ch x Am)]}):B_4	69	3	1
(Ch x Am) x (Ch x Am): F_2	3	5	3
[Ch x Am) x (Ch x Am)] x [Ch x Am) x (Ch x Am)]:F_3	0	0	0
[Am x (Ch x Am)] x [Am x (Ch x Am)]: B_1-F_2	366	8	8
{Am x [Am x (Ch x Am)]} x {Am x [Am x (Ch x Am)]}:B_2-F_2	5	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		46	1
B_3-F_3	1171	9	8
Chinese x (Chinese x American): Chinese B_1	-1	1	0
Chinese x [American x (Chinese x American)]	85	7	7
Chinese x {American x [American x (Chinese x American)]}	-141	11	0
Chinese x Chinese	-449	-3	
Chinese x Japanese	0	0	
Chinese x European	0	0	
Chinese x Large, Surviving American	-135	-3	-3
European	0	0	0
European x American F_1	0	0	0
Japanese	-2	-1	-1
Japanese x American F_1	0	0	0
[(Japanese x American) x American] B_1	0	0	0
{[(Japanese x American) x American] x American} B_2	0	-1	-1
Japanese x European	0		

Japanese x Large, Surviving American	0		0
Castanea ozarkensis	30	1	2
Castanea pumila	39	2	2
Castanea seguinii	0	0	0
Large Surviving American F_1	324	31	3
Large Surviving American B_1	95	5	-18
Large Surviving American B_2	75	2	-2
Large Surviving American I_1	385	11	9
Large Surviving American I_2	-26	2	2
Large Surviving American I_3	88	1	1
Large Surviving American F_2	-7	5	1
Large Surviving American F_3	320	1	1
Large Surviving American other	0	0	0
Other	30		
Total	**9738**		

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

Table 3. The American Chestnut Foundation Meadowview Farms 2008 nut harvest from controlled pollinations and selected open pollinations

Nut Type*	Female Parent	Pollen Parent	Pollinated			Unpollinated Checks			Number of Crosses
			nuts	bags	burs	nuts	bags	burs	
AxA	American	American	12	39	86	.	.	.	1
B_1	American	opDunstan F_1	193	89	249	0	17	18	6
B_1	mollissima11 F_1	American	4	26	29	0	4	5	3
B_1-F_2	72-211 B_1	72-211 B_1	57	56	116	0	70	7	4
B_1-F_2	Nanking B_1	Nanking B_1	289	305	757	0	35	43	3
B_1-F_3	B_1-F_2 Clapper;Graves	open pollinated	17271		6128				9
B_1xC	MusickChinese B_1	MuChin1 Chinese	20	128	205	0	8	14	4
B_1xC	Nanking B_1	Nanking Chinese	67	97	217	0	10	18	4
B_2	American	72-211 B_1	435	184	399	2	18	22	14
B_2	American	mollissima10 B_1	39	74	103	0	9	6	3
B_2	Nanking B_1	American	137	134	229	0	22	16	4
B_2-F_2	Nanking B_2	Nanking B_2	20	101	205	0	10	13	3
B_2-F_2	R11T14 B_2	R11T14 B_2	5	122	342	0	8	29	1
B_2-F_3	B_2-F_2 op Clapper	open pollinated	10764		4495				5
B_2-F_3	B_2-F_2 Graves	open pollinated	1467		1149				3
B_2xC	MusickChinese B_2	MuChin1 Chinese	0	13	20	0	1	1	1
B_3	American	MusickChinese B_2	89	174	294	1	16	24	11
B_3	American	Nanking B_2	129	161	336	1	23	46	10
B_3	Chapter		2446	2664	7595	8	290	741	57
B_3-F_2	Clapper B_3	open pollinated	7859		4422				49
B_3-F_2	Graves B_3	open pollinated	16926		10147				46
B_3-F_2	Graves B_3	Graves B_3	60	132	371	0	14	35	2
B_3-F_3	Clapper B_3-F_2	open pollinated	2433		1472				41
B_3-F_3	Graves B_3-F_2	open pollinated	1659		949				37
B_4	American	Douglas B_3	69	82	156	0	9	14	6
CxC	Meiling Chinese	Mahogany Chinese	11	40	.	0	3	2	
CxC	Nanking Chinese	Mahogany Chinese	27	28	47	0	3	3	
CxC	Nanking Chinese	Vanuxem Chinese	93	165	519	0	19	26	
F1	Kuling Chinese	American	18	89	.	4	5	9	1
F1	Meiling Chinese	American	192	209	100	1	17	25	2
LSA B_1	American	NCChamp LSA F_1	338	149	358	1	15	31	3
LSA B_1	American	Ort;Ort LSA F_2	30	102	186	0	13	24	7
LSA B_1	Corrigan LSA F_1	American	68	17	40	0	3	5	1

LSA B_1	Ort;Ort LSA F_2	American	244	98	229	3	20	8	2
LSA B_2	American	Ort LSA B_1	95	46	55	0	5	5	4
LSA B_2	DaresBeach LSA B_1	American	75	26	56	0	2	6	1
LSA B_2	NCF179 LSA B_1	American	5	5	18	0	1	4	1
LSA B_2	Ort LSA B_1	American	124	173	324	0	14	22	2
LSA F_2	NCChamp LSA F_1	NCChamp LSA F_1	17	110	118	0	11	16	3
LSA F_3	Ort;Ort LSA F_2	Ort;Ort LSA F_2	336	163	370	0	11	25	3
LSA I_1	Amherst LSA F_1	WayahBig LSA op	4	30	54	0	4	8	3
LSA I_1	DaresBeach LSA B_1	WayahBig LSA op	11	66	141	0	7	18	1
LSA I_1	DaresBeach LSA F_1	NCChamp LSA F_1	13	38	108	0	4	9	1
LSA I_1	NCChamp LSA F_1	WayahBig LSA op	10	25	103	0	2	1	2
LSA I_1	Ort LSA B_1	Amherst LSA F_1	93	47	173	0	8	16	2
LSA I_1	Ort LSA B_1	CareyMacon2 LSA op	8	30	44	0	3	4	1
LSA I_1	Ort LSA B_1	NCF179 LSA B_1	89	32	68	0	3	10	1
LSA I_1	Ort LSA B_1	WayahBig LSA op	77	186	418	0	11	24	3
LSA I_1	Ort LSA F_1	CareyMacon2 LSA op	17	48	86	2	5	8	1
LSA I_1	Ort;Ort LSA F_2	CareyMacon2 LSA op	73	39	82	9	3	12	1
LSA I_1	Ort;Ort LSA F_2	NCF179 LSA B_1	10	18	17	0	1	2	1
LSA I_1	Ort;Ort LSA F_2	WayahBig LSA op	1	10	8	0	2	3	1
LSA I_1	ScientistsCliffs LSA B_1	WayahBig LSA op	6	17	27	0	1	1	1
LSA I_1	WayahBig LSA op	Weekly LSA op	85	61	144	0	6	10	1
LSA I_1	DaresBeach LSA op	CareyMacon2 LSA op	0	21	10	0	.	.	2
LSA I_1	Weekly LSA op	NCChamp LSA F_1	72	48	69	0	6	9	1
LSA F_1	American	opDaresBeach;Ort LSA I_1	258	94	182	3	7	16	3
LSA F_1	opDaresBeach;Ort LSA I_1	American	37	26	47	1	4	9	1
LSA I_2	opDaresBeach;Ort LSA I_1	NCChamp LSA F_1	265	95	261	6	21	7	1
Total Controlled Pollinations, w/o Chapter			**4427**	**4268**	**8576**	**34**	**514**	**689**	

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

Table 4. Mean, standard deviation and distribution of chestnut blight canker size classes (mean length and width of cankers incited by two strains of the blight fungus) for Chinese-American B_3-F_3 progeny from the Clapper source of blight resistance, in 2008

Mother	Mean	Standard	Canker Size Class (cm)				
			1.0-2.6	2.6-4.2	4.2-5.8	5.8-7.4	7.4-9.0
D5-17-111	4.1	0.7	1	10	7		
D5-17-121	4.4	1.6	1	2	3		1
D5-17-21	3.7	1.0		1	1		
D5-18-126	4.1	0.8	2	17	17	1	
D5-18-138	4.1	1.0		2	2		

Table 5. Mean, standard deviation and distribution of canker size classes (mean length and width of cankers incited by two strains of the blight fungus) for straight F_2, B_1-F_2 and B_2 American x Chinese chestnut progeny and controls, in 1993.

Cross Type	Mean	Standard	Canker Size Class (cm)						
			1.0-2.6	2.6-4.2	4.2-5.8	5.8-7.4	7.4-9.0	9.0-10.6	10.6-
Seedling American	9.6	1.1					3	5	2
F_1 'Nanking'	8.4	1.0				2	4	3	
Seedling Chinese	5.2	1.0		2	7	3			
'Meiling' Chinese	5.5	1.1		1	2	2			
'Nanking' Chinese	2.9	1.4	3		2				
F_2 'Mahogany'	7.7	1.9		5	23	48	48	29	15
B_1-F_2 'Clapper' x 'Graves'	6.9	1.9	4	25	84	116	112	54	4
B_2 'Graves'	9.1	1.5			2	4	15	26	6

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American chestnut: The "a" is capitalized, the "c" of the second word is not.
Blight-resistant: is hyphenated, as in "blight-resistant chestnut" or "the tree will be highly blight-resistant".

Blight resistance: is not hyphenated, as in "The tree will have sufficient blight resistance."

Bur: is preferred to "burr"

Backcross: single word

Backcross breeding: The process used by TACF. Selected offspring of the first cross between Chinese and American chestnut are crossed with, or 'back to', American chestnut only in subsequent generations. The term 'Cross breeding' should be avoided because it implies multi-generation crosses between species, varieties, or breeds. In cross breeding, selected offspring of the first cross may again be crossed with other species, varieties, or breeds in subsequent generations. The term 'breeding' may be used, as it refers to more generally to crossing within species, varieties, or breeds.

Escaped infection: preferred usage for uninfected wild-growth trees rather than 'survived'.

Scientific Names: please visit www.acf.org/TACFWritingGuide.pdf for a list of scientific names

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