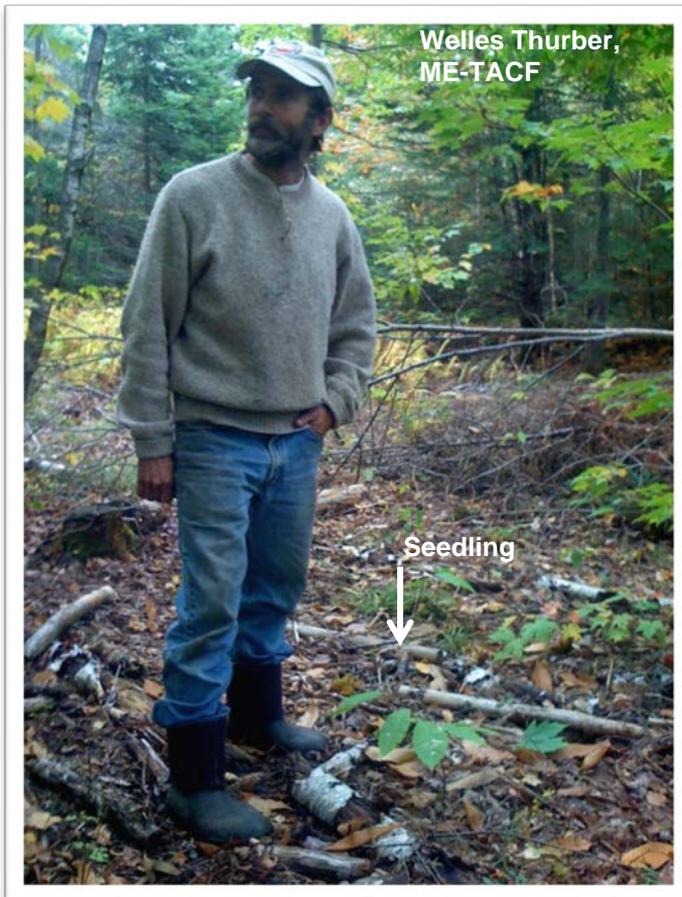


American Chestnut Plantings

Type of Planting	Sites	Purpose & Intention
Display Plantings	Urban, Parks, Schools	Education, Recreation Chestnutting
Orchards	Rural, Farms, Tree Farms, University (One acre, irrigation, mowing)	Backcross breeding Nut production (Sustainable agriculture) Hardwood improvement (Adding other disease management)
Habitat Plantings	Afforestation Sites Forest Woodlots Reclamation sites (Small to Large)	Testing Restoration and Blight resistance. Assessing mixed planting competitiveness. Conservation ecology: impact on other species. Establishing high value timber source.
Native Chestnut Nurseries	Accessible sites for transplanting Kentucky stump sprouts	Preservation of trees from ecological areas in Kentucky for future breeding.

Where we want to be...

For the first ten years or so, Welles Thurber defended these Maine American chestnuts against MOOSE with cages. At 20 years, they are producing sufficiently mast that there are now seedlings. Success !



Habitat Plantings

- Funding by USFWS for Private Landowners for solar deer fencing, other materials. Match is 50%. Involves signing both Cooperative Agreement (USFWS) and Germplasm Agreement. National TACF provides advanced hybrids when possible.
- Proposal is designed to mix a primary field colonizer and two mast species.
- Plantings are small enough to be managed intensively by one to two persons.

(If interested you can download [Habitat Packet for Owners](#), or take a copy today.)

Sample Habitat Planting – Meyring Planting Fall 2011



Data Management Starts with a Schematic Excel Map

This map of the Meyring Planting updates mortality as of 7/10/12

American Chestnut Planting by American Chestnut Foundation and KY Division of Forestry
Mike and Brenda Meyring Farm, Estill County - GPS: N 37.56847 x W-84.07027
7/10/2012

Row 1	X	#2 American Chestnut alive 19"	#3 Red Oak alive 12"	#4 White Pine dead	#5 American Chestnut* dead	#6 White Pine dead	#7 Red Oak alive 10"	#8 American Chestnut alive 10"	#9 White Pine dead	#10 White Pine dead
Row 2	#11 White Pine dead	#12 American Chestnut dead	#13 White Pine dead	#14 Red Oak alive 10"	#15 American Chestnut* dead	#16 American Chestnut alive 25"	#17 White Pine dead	#18 American Chestnut alive 24"	#19 White Pine dead	X
Row 3	#20 Native American Chestnut alive 54"	#21 American Chestnut alive 16"	#22 Red Oak alive 13"	#23 American Chestnut alive 22"	#24 White Pine dead	X	#26 Red Oak alive 10"	#27 American Chestnut alive 30"	#28 White Pine dead	#29 Native American Chestnut alive 54"
Row 4	#30 White Pine dead	#31 American Chestnut alive 10"	#32 Red Oak alive 6"	#33 American Chestnut alive 25"	#34 Red Oak dead	#35 Native American Chestnut dead	#36 American Chestnut* dead	#37 White Pine dead	#38 American Chestnut dead	#39 Red Oak alive 8"
Row 5	#40 White Pine dead	#41 Red Oak dead	#42 American Chestnut* dead	#43 Native American Chestnut alive 96"	#44 Red Oak alive 7"	#45 American Chestnut alive 22"	#46 White Pine dead	#47 American Chestnut* alive 17"	#48 White Pine dead	#49 American Chestnut alive 14"
Row 6	#50 American Chestnut alive 24"	#51 White Pine dead	#52 Red Oak alive 14"	#53 American Chestnut* dead	#54 White Pine dead	X	#56 Red Oak dead	#57 American Chestnut* dead	#58 White Pine dead	#59 White Pine dead
Row 7	#60 White Pine dead	X	#62 American Chestnut* dead	#63 Red Oak dead	#64 White Pine dead	#65 American Chestnut* dead	#66 Native American Chestnut alive 52"	#67 Red Oak alive 6"	#68 American Chestnut dead	#69 White Pine dead
Row 8	#70 American Chestnut alive 26"	#71 White Pine dead	#72 Red Oak alive 11"	#73 American Chestnut dead	#74 White Pine dead	#75 American Chestnut alive 25"	#76 White Pine dead	#77 American Chestnut dead	#78 White Pine dead	#79 White Pine dead

Notes: AC= MV W5-31-35

B3F3 2011

* Green Mesh Pot

Analyzing the Data

Without accurate and recurrent yearly observations, we can't learn about what changes to make to improve outcomes. For example, we can't compare across different types of sites.

This is a simple Excel pivot table of the information on the previous map with data from the Meyring planting. It shows high mortality due to combined late frost and heat & drought in 2012. The oaks, while much smaller in growth than chestnuts, are actually surviving better than the chestnuts.

Type	Planted	Dead	% Survival
KY AM	7	3	57%
B3F3	29	14	52%
Oak	15	4	73%
Grand Total	51	21	59%

The goal is to achieve 80% survival, so modifications in management will be considered and replanting may be indicated.

Plantings that have an active “chestnut steward” are essential so we can develop successful “best practices.”

Jefferson Memorial Forest with Volunteer Cindy Payne (Chestnut Steward) and Bryan Lewis (Natural Resources Manager) – Spring 2012

The success of this planting is directly related to the interest and monitoring by Cindy (middle), who spotted problems with deer damage early in 2011 so that the deer fence could be modified (covered to deer net).



Spring 2012, adding new chestnut sources
(Others from Seed 2011)

Breeding Orchards



2012

**Ashbourne Farms
Planted 300 nuts 3/25-29/2012**

So far:

Flooding spring rain

Frost: 92% died back, about 50% recovery.

Heat

Drought



2008

2009



Meades Landing - 2008 Trees: June 2012 (mid-5th year)

Drop a nut in a Blue X, after making hole with bulb planter, tamp down, add scant cover, stabilize with bamboo stake and tag, close with clothes pin at top until sprouts.



Anne Bobigian, KY-TACF, and Diana Olszowy, KY Division of Forestry, planting Meades Landing in 2008, staked and flagged, with BlueXs at each site. Planting nuts takes about 5 minutes per nut.

Adaptive Management The Art of Solving Problems First -- Deer !!



Deer Fencing: 2009 Spring First Flush of Recovery.
Trees browsed all developed multiple leaders.

Meades Landing Orchard: 2008
Round Up, Staking at 6 ft intervals: Angus MacLean,
Cary Perkins, and Anne Bobigian: ~April 1, 2008
Seed Planting: April 6-10, 2008
Deer: complete browse July 1, 2008



Weed Management Ashbourne Farms

Beware disturbed plowed ground:
how to manage when glyphosate
and mowing isn't enough?



Drought and Irrigation

Dead seedlings at Ashbourne farms from heat and drought. Chestnut is very sensitive to drought in the first year of establishment, but also drowns with any flooding.

How much water is enough?



Using Irrrometers to Monitor Soil Moisture

Two Irrrometers are need to accurately monitor soil moisture in the upper 12" and the lower 24" depth. These allow accurate scheduling of irrigation and determination of how much water it takes to achieve a good range – 10-15.



Display Plantings

You can't miss what you've never experienced...

We need to have trees where our population lives to create a new connection . . .



Trees planted in 2008 in Curlew Park, in Audubon Park, picture taken in 2009, shows failing wilting tree below arrow.

Missing tree: *Phytophthora cinnamoni* (ink disease) death in August 2010
Other trees treated with Agri-Fos with recovery. Urban soils should be assumed to have phytophthora.



Urban Chestnuts in Audubon Park

Urban chestnuts benefit particularly from being planted near rotting stumps – the nurse log phenomenon !



Planted adjacent to old Pin cherry stump 2007

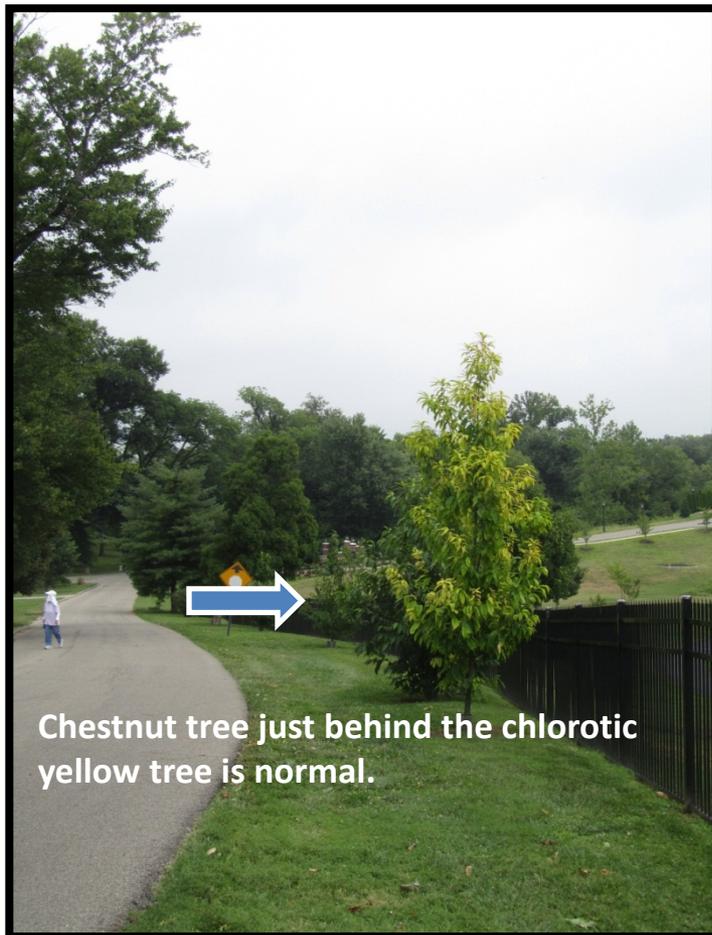


23 ft. Tall in 2011

Display Plantings - Street Trees

Site Preparation : Reduce Compaction

Planting on road easement sites can be like planting in concrete. Use “airknifing” to assess buried objects and punch down through urban hardpan and improve drainage.





Growing Individual Chestnut Trees

Single Cage Protection

**Nut protection
Deer Protection**

Make sure you can open the cage for weeding inside – use cable ties that can be released.

Cages grow great vines – porcelain berry, poison ivy, and so on.

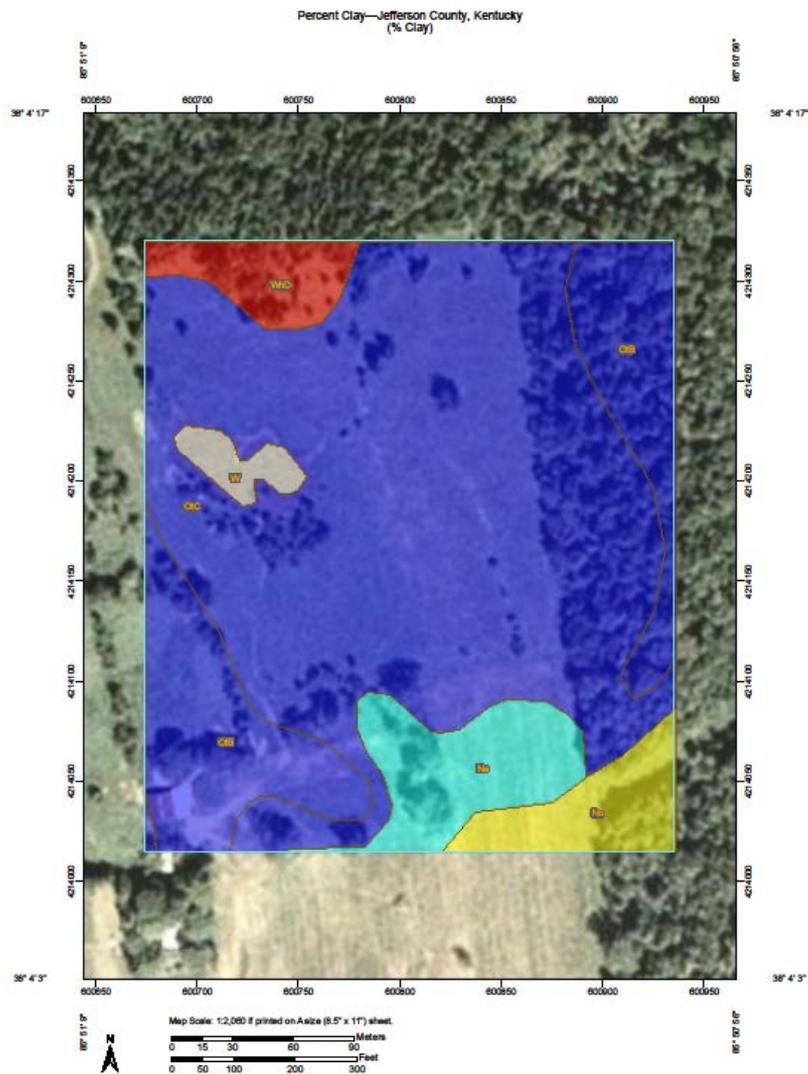


For Heavy Deer Pressure With a free hardware cloth.

Hardware cloth is particularly hard to weed and gets weeds and roots embedded at the edge. Use a larger diameter circle and spray perimeter frequently.

Evaluate and Know your Site

Use the Web Soil Survey Online



Site Preparation: Subsoiling

It takes a big tractor to do sub-soiling. Soil must be dry to do it, so you don't re-compact the site with the weight of the machinery.

Ferenc Vegh donated his tractor and time in Fall 2011 to subsoil the Wilkins Farm planting site. He developed his experience subsoiling to establish vineyards in Shelby County.



Sub-Soiling

Knowing your soil characteristics is just a first step in site evaluation.

Knowing the history of land use is equally important. Pastures and old agricultural fields often have compaction or a “plow layer” that impedes drainage, and using sub-soiling can be effective to break up these layers and reduce compaction. These are three foot teeth !



One of the lessons of the Appalachian Reforestation initiative is how compaction prevents normal tree growth (creating “bonsai” trees) and severely reduces survival.

See [Forestry Reclamation Advisory No. 4.](#)

Seed Effects

Much of the difference in first year growth between these seedling is the difference in initial seed size. These are large Chinese nuts on the right compared with 15/16th American's on the left. Small nuts need more field care to establish.



Some Common Requirements in all Plantings

Plant by **direct seeding** with enough chestnuts to allow for at least 50% losses. Plan to plant three years in a row. Plant at least three unrelated groups of chestnuts.

All chestnut plantings are “long-term projects”. Plan for active management for 5-10 years. There must be an on-site **chestnut steward** who will pass by the site in order to catch problems early during the growing season.

Maximize site preparation:.

- **Decompaction** (Urban: air-knifing; Rural: deep subsoiling, not tilling).
- Analyze soil and site characteristics: % clay, and depth to restrictive layer, Northern Red Oak or White Pine index. GET GPS Coordinates and use the **Web Soil Survey** Site to run various soil reports.
- Consider raised beds using composted bark, especially pine bark.
- Maximize early canopy closure, but plan for first removals.

Protect against predation at every level:

- Nut: Rodents (Squirrels, Raccoons, Mice) and Birds; Coyotes/Dogs.
- First Sprout: Rabbits and Geese
- Seedling/Sapling: Deer, Deer, Deer – and Elk, Moose (to 12 ft). Herbivory and Buck rub !
- Nut production: And last but not least, *Bears climb and strip trees*.

Develop an irrigation and drought plan before planting: Start with some access to water; develop a way to monitor soil moisture (Irrrometer); consider use of polyacrilamide gels, individual ooze tubes, drip irrigation.

Maintenance: Weed and Invasive management: consider planting cover crops; mulching; layout for ease of mowing; frequency of herbicide applications; fertilizer

Disease Management: Learn the signs and how to manage the *other pests and pathogens*: Asian Ambrosia Beetle; Phytophthora cinnamoni; Chestnut Gall Wasp; Cryptodiaporthe castanea; and Chestnut weevils.

Keep track of it all – data management enables to us to know what works and what doesn't...

Let me repeat – My Personal “Best Practices” Approach

Defined as anything relatively cheap that gives dependable outcomes, or makes the job manageable by someone over 75 or makes it foolproof because it automates it.

- 1. Choose site with some slope, some tree barrier edge of wind protection, soil with <30 % clay, and depth of 4 ft, and consider *decompaction* by subsoiling if an agricultural field or pasture site, or by air-knifing in urban soils. Every open field will be windier than you expect !**
- 2. Use direct seeding: fast, easy, and trees grow just as fast. Plant a mix of seed: if pure chestnuts, at least two different sources, preferably three. Replant in a second and third year to diversity the site. If possible on Habitat sites, plant two mast species, and a third field colonizer that won't sprout when thinned. In permanent plantings, avoid a monoculture. Monocultures call in every chestnut pest !**
- 3. Be paranoid. Even 15 minutes of inattention can lose your nuts & seedlings. Use BlueXs for two to three years for nut protection, then consider other methods of vole protection. For deer protection in orchards and habitat sites, use solar electric Deer QuikNet. A single small person can set up a fence in a couple of hours. For small numbers of individual single trees, in public areas, use four foot high kennel fencing closed with cable ties that can be released for weeding. Hardware cloth is unpleasant to cut and handle, durable and effective, but very difficult to weed.**
- 4. Planting at 8 ft spacing should give you weed suppression at 4 years, if you leave branches to the ground, but only if your trees grow vigorously. In the meantime, mow closely, use composted mulch or pine needles liberally in the row, spray herbicide (glyphosate) early and often (about once per month), and consider establishing a tree compatible ground cover, like white clover and buckwheat. Don't begrudge the cost of mulch. Expect to do hand weeding several times per year; mulching makes this much easier. If your trees don't grow quickly, weed suppression, and invasives become a bigger and bigger problem as you spray glyphosate repeatedly, since you select for bad actors – like perennial bind weed.**
- 5. Irrigation: Drip irrigation allows use of injectors to treat for Phytophthora with soil drenches. Ooze tubes, on 15-20 trees, can be managed with truck and water tank. If no possible irrigation, consider adding ½ cup of hydrated polyacrylamide gel to each hole at time of planting. Watering the first year is absolutely the best method to get trees well-established with quick growth and good form.**
- 6. *Other disease management:* Have a plan for all the major disease & pest issues and recognize them early. You can have a wonderful orchard despite multiple management issues.**

Nuts and Bolts of Back Cross Breeding Orchard

Layout and Hardscape Items: Site, Deer Fencing, Irrigation

Backcross Orchards are part of the scientific program of the American Chestnut Foundation for breeding regionally adapted American chestnut trees for eventual restoration of blight resistant tree. This is a managed volunteer program, and biological materials are subject to the TACF Germplasm agreement (see attached). Materials remain the property of the American chestnut foundation.

Sample Backcross Orchard: 2 or 3 Lines of ~100 15/16th KY Back cross nuts, and 20 controls (Chinese, Americans and F1s). The sample below is for 3 line orchard. (Simply reduce row length to ~210 ft and rows to 6 for a two line orchard.) Any orchard with rows longer than 300 ft is harder to manage!

Layout: 40 sites at 6 to 7 ft. apart (240 to 280 ft), with rows 15 ft. apart x 8 rows: 320 sites, with edges of 20 ft. along rows and 20 ft. either side at end of rows. Area for 6 ft. within row layout: (274 x 145 ft.) 39730 sq. ft. or .92 acres

Deer Fencing: For Solar Electric Fence, use Deer QuikNet with solar energizer with posts at corners, at gate and midway in all four sides: linear foot is ~300 x 150. Total 900 ft with (~10 posts). You must get a digital volt meter and use it – verify your fence is working every time you visit.

Irrigation: There must be a water source. Plan for drip irrigation to 8 rows: 8 x ~240 is ~ 2000 linear ft. of drip emitter line, which comes in 1000 ft rolls (and is light). It does take two people to effectively roll it out. Buy high quality ‘permanent drip emitters’ with 24” spacing. This allows use of Injectors for chemical treatments. Injectors (like the Mini-Dose 1% or 5%) don’t require electricity, and are relatively inexpensive. Irrigators (tensionometers) are effective tools to place in the field to monitor soil moisture and determine scheduling and volume of irrigation.

Time Line for Back Cross Breeding

Year 0: Fall: Stake rows and establish Deer Fence. Or at least establish corners of site. If possible, establish rows with Glyphosate.

Year 1:

March: Flag rows at 6 or 7 ft. interval, spray again with RoundUp.

April: Layout BlueXs and Bamboo stakes. Plant two lines in alternating rows 1, 2, 4, 5, 7. Plant controls, if available. Reserve rows 3, 6, 8 for Third line. Place permanent tags for sites planted.

May 15: Treat with Roundup, establish drip irrigation lines, fertilize with Osmocote, and mulch with composted bark. Assess germination.

June: Reassess germination. Consider mefenoxam soil drench (for *Phytophthora cinnamoni*) and Agri-Fos monthly x 3 treatments.

July-August: Treat with Glyphosate for weed control approximately monthly and mow as needed. Hand weed BlueXs as needed.

September: Measure height and mortality.

Year 2:

March: Flag, stake and tag rows 3, 6, 8 for Line 3.

April: Plant third line and fill in with controls. Prune existing rows for basal sprouts.

May: Treat with RoundUp, establish irrigation in three new rows. Fertilize all rows with Osmocote. Assess germination. Mulch new rows. Mefenoxam soil drench in May and September, with Agri-Fos foliar spray, June, July, August.

July-August: Continue Weed Control and Mowing.

September: Measure heights and mortality.

November (Dormancy): Corrective pruning.

Year 3:

March-April: Begin monitoring for Asian Ambrosia Beetle: degree days and traps.

May 1: Assess bud flush and leafing out times weekly. RoundUp for weed control. Apply Osmocote. Remove BlueXs, if necessary and replace with alternative vole protection.

June 1-15: Assess catkin blooming in rows 1, 2, 4, 5, 7.

May-August: Weed maintenance: Apply RoundUp and mow.

September: Measure Heights & Mortality, add DBH to data.

Dormancy: Corrective and Structural pruning

Year 4: Continue fertilizer, maintenance, weed control and assessments. Add DBH measurement to data.

Year 5: Continue fertilizer, maintenance, weed control and assessment. Evaluate trees for possible inoculation.

Year 6 & 7: Maintenance. Inoculation and Selection for resistance (1 in 8 trees). Collect any open pollinated "mutt" nuts.

Year 8 & 9: Remove non-selected trees. Intercross selected trees (4-6 per line) and move seeds to the seed orchard.