
LESSONS FROM THE FIELD: THE FIRST TESTS OF RESTORATION AMERICAN CHESTNUT (*CASTANEA DENTATA*) SEEDLINGS PLANTED IN THE SOUTHERN REGION

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An exotic fungus, the chestnut blight (*Cryphonectria parasitica* Murr. Barr), decimated the American chestnut tree (*Castanea dentata* Marsh. Borkh.) throughout eastern North America in the first half of the 20th century. The United States Department of Agriculture, Forest Service (FS), The University of Tennessee, and The American Chestnut Foundation (TACF) are collaborating on chestnut restoration research on National Forest System lands. In autumn 2007 and 2008, TACF used a back-cross breeding technique (Hebard 2001) to produce chestnuts, referred to as the BC3F3 generation, that are predicted to be American chestnut in character with blight resistance from Chinese chestnut (*Castanea mollissima* Blume).

Chestnut seedlings from four generations (BC1F3, BC2F3, BC3F2, and BC3F3) and two parental species (American and Chinese) were grown as high-quality 1-0 seedlings (Kormanik et al., 1993), averaging 3.1 and 4.3 ft in height and 0.5 and 0.6 inch in root collar diameter for 2009 and 2010 plantings, respectively. Trees were out-planted into five shelterwood harvests (residual basal area of 10-20 ft² acre⁻¹) on three southern National Forests in 2009 and 2010. Six more plantings were established in 2011 but have not yet been evaluated. Prior to plantings, we divided trees into Large and Small size classes based on visual assessment (Clark et al. 2000). We evaluated seedlings in the first

growing season for bud-break phenology, survival, height growth, and presence or absence of chestnut blight and deer browse to the terminal bud.

The BC3F3 generation seedlings were slightly more developed than American chestnut seedlings in bud-break phenology, indicating a departure from the more desirable American chestnut phenotype. First-year survival ranged from 80-93 percent at each location, except one location planted in 2010 that had 44 percent mortality due to a high water table and poor drainage on the site. This site also had the greatest incidence of chestnut blight with 4 percent and 3 percent of the BC3F3 generations and American chestnuts, respectively, with blight. Chestnuts were capable of fast-growth in the first year after planting if not browsed by deer, averaging 3 and 7 inches in height growth for 2009 and 2010 plantings, respectively. Browsed seedlings were 7 inches (2009) and 16 inches (2010) shorter after year 1 compared to unbrowsed trees. Seedlings classified as Small at planting had more browse and more growth than seedlings classified as Large, but Large seedlings remained 11 and 18 inches taller than Small seedlings at the end of year 1 for 2009 and 2010 plantings, respectively. Deer browsing was location specific ranging from 3 percent to 80 percent of trees browsed at each site. In both years, American chestnut and BC3F3 generation seedlings were

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not different in height growth, and Chinese chestnuts had significantly less height growth than American chestnuts and all generations. In 2010, Chinese chestnut seedlings had the best survival (100 percent) compared to Americans and all generations, but had the worst survival in 2009 (81 percent).

Using high-quality seedlings with terminal buds that are above the deer browse line (~4.5 feet) and/or the use of deer protection for smaller seedlings will be a requirement for the successful restoration of American chestnut in areas with high deer populations. At the beginning of the second growing season hard plastic mesh shelters (5 feet tall) were erected at plantings that had significant deer browsing in the first year. Results presented here are preliminary, but show that chestnut is capable of relatively fast growth and good survival after one growing season if the site is well-drained and free of deer browsing pressure.

The biggest challenges identified by field managers from the NFS were providing and maintaining deer protection, having sufficient financial resources to carry out reforestation and to support research efforts, the lack of available material for planting, and identifying proper areas for planting blight-resistant chestnuts. A major anticipated challenge that was not identified as a significant problem in this study was *Phytophthora cinnamomi* Rands, an exotic soil pathogen that kills the root system of chestnut plants, particularly on lower-quality sites with wet, compacted soils (Rhoades et al. 2003). Proper planning and resource support are needed to overcome these challenges. Future results from this and similar studies will be used to guide and maximize efficiency of reforestation efforts on NFS lands.

LITERATURE CITED

- Clark, S.L.,** Schlarbaum S.E., and Kormanik, P.P. 2000. Visual grading and quality of 1-0 northern red oak seedlings. *Southern Journal of Applied Forestry* 24(2): 93-97.
- Hebard, F.V.** 2001. Backcross breeding program produces blight-resistant American chestnuts (Virginia). *Ecological Restoration* 19(4): 252-254.
- Kormanik, P.P.,** Sung, S.S., and Kormanik, T.L. 1993. Towards a single nursery protocol for oak seedlings. In *Proceedings of the 22nd Southern Forest Tree Improvement Conference*, Atlanta, GA. Sponsored Publ. No. 44 of the Southern Forest Tree Improvement Committee. The National Technical Information Service, Springfield, VA: 89-98.
- Rhoades, C.C.,** Brosi, S.L., Dattilo, A.J., and Vincelli, P. 2003. Effect of soil compaction and moisture on incidence of phytophthora root rot on American chestnut (*Castanea dentata*) seedlings. *Forest Ecology and Management* 184: 47-54.