American Chestnut Restoration: Effects of Breeding on Blight Resistance and Field Performance in Tennessee, USA

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The American chestnut (*Castanea dentata*) was a keystone species in eastern North America providing important ecosystem services and economic benefits to rural communities, particularly in the southern Appalachian mountains. Chestnut blight caused by *Cryphonectria parasitica,* has drastically reduced American chestnut populations and altered tree species composition for the last 100 years. A field reintroduction trial using hybrid American chestnuts and parental species was established in 2010 in eastern Tennessee USA. The hybrids were produced using a backcross breeding approach that integrates blight resistance from Asian chestnut species into the American chestnut genome. Pedigreed bare-root (1–0) nursery seedlings (n=513) were planted to test effects of breeding, genetics, and seedling size class on field performance. Mortality was highest the first two years after planting, and Phytophthora root rot (PRR), caused by *Phytophthora cinnamomi,* was probably a significant contributor. Chinese chestnut (*C. mollissima*) had the highest eight-year survival (96 percent) compared to American chestnut (34 percent) and hybrid generations, including the most advanced generation, the BC_3F_3 (41 percent). Less advanced hybrid generations, such as the BC_1F_3 and BC_2F_3, had the tallest eight-year stem height. We identified superior and inferior BC_3F_3 families based on blight resistance rankings and growth. Seedling size class, identified at the time of lifting seedlings from the nursery just prior to planting, affected survival and growth of generations and genetic families differently. Nursery production and restoration plantings should consider genetic effects and interactions with seedling size class to better refine and improve planting outcomes. The breeding program was successful in integrating desired American chestnut growth traits into the hybrid genome, while transferring an intermediate level of resistance from the Chinese chestnut. Long-term viability of the BC_3F_3 generation seedlings in this experiment is questionable as trees increasingly succumb to chestnut blight over time.