

Status and Future of Breeding Disease-Resistant American Chestnut¹

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The American Chestnut Foundation (TACF) has worked since 1983 to introduce genetic resistance to the chestnut blight fungus (*Cryphonectria parasitica*) into an American chestnut (*Castanea dentata*) population. As part of a broader goal for species restoration, TACF seeks to instill within that population sufficient diversity so as to enable the species to reproduce on its own in forests throughout its native range. Dr. Charles Burnham proposed introgressing blight-resistance from Asian chestnut species into a predominantly American chestnut genetic background with backcross breeding. Hybrids of American chestnut and Chinese chestnut (*C. mollissima*) were backcrossed to American chestnut over three generations. Third backcross trees (BC3s) selected for resistance to chestnut blight were intercrossed to generate a segregating population of BC3-F2 trees. Currently, TACF has advanced two sources of resistance, derived from two first backcross trees with different Chinese chestnut grandparents to the BC3-F2 generation. Over 60,000 BC3-F2s from these sources have been planted in seed orchards at TACF's Research Farms in Meadowview, Virginia since 2002. After artificially inoculating seed orchards with the chestnut blight fungus and culling individuals with significant canker expansion, 5,000 trees remain from which to make the final selections of the 500 most resistant trees.

While TACF has achieved successes toward the creation of a disease-resistant American chestnut, uncertainties about the genetic control of blight resistance remain after 30 years of backcross breeding under the Burnham plan: the number of loci that control blight resistance is not known with confidence; it is uncertain whether alleles that confer blight resistance are segregating at the same or different genetic loci across sources of resistance; it is uncertain whether blight resistance alleles are lost through backcrossing; and it is uncertain whether there are genetic interactions between host resistance and pathogenicity in different strains of *C. parasitica*. Future work at TACF will seek to resolve these uncertainties and improve the efficiency and efficacy of traditional breeding for disease-resistant American chestnuts.

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