The Importance of Site Quality to Backcross Chestnut Establishment Success[1]

C.C. Pinchot,[2] A.A. Royo,[3] M.P. Peters,[2] S.E. Schlarbaum,[4] and S.L. Anagnostakis[5]

Short-term studies show that American chestnut (*Castanea dentata*) grows faster on mesic compared to xeric sites. Long-term impacts of site quality and corresponding moisture and nutrient availability on backcross chestnut establishment success and resistance to the chestnut blight fungus, *Cryphonectria parasitica*, however, have not been evaluated. We report here the first year results from a study designed to evaluate the effects of three site quality treatments—mesic, xeric, and intermediate—on the establishment success and blight resistance of chestnut seedlings planted on the Allegheny Plateau in northwestern Pennsylvania. We hypothesized that long-term chestnut growth and competitive ability will be greatest on sites intermediate in resource availability, and severity of blight will be lowest on mesic sites.

In April, 2015 we planted 360 backcross (BC_3F_1 x BC_3F_2), 90 American, and 90 Chinese (*C. mollissima*) chestnut seedlings in 15 recently-harvested sites. Study sites were categorized as mesic, xeric, or intermediate using the integrated moisture index (IMI) (Iverson, L.R.; Dale, M.E.; Scott, C.T.; Prasad, A. 1997. A GIS-derived integrated moisture index to predict forest composition and productivity of Ohio forests (USA). Landscape Ecology. 12(5): 331–348.), which calculates moisture ratings using digital GIS-derived topographical features and soils data. Soil characteristics for each site, including NO_3, NH_4, Ca, P, K, and Mg levels; percent sand, clay, and organic matter; and plant available water, were evaluated from soil samples. Chestnut seedlings were planted as 1-0 nursery stock, averaging 1.2 m in height and 11.6 mm in root collar diameter at planting. After 1 season, seedlings had grown an average of 7 cm (± 21) in height and 1 mm (± 2) in diameter. Growth did not differ among the IMI treatments, but differences were found among chestnut types. Chinese chestnut height growth was greatest (P = 0.009, 11 cm ± 3), with no significant differences between American and hybrid chestnuts (between 4 cm ± 2 and 9 cm ± 3). Ground level diameter ranged between 0.3 mm ± 0.3 and 1.3 mm ± 0.3 and was lowest for the American and one hybrid chestnut family (P = 0.001). Multiple regression models indicate that diameter growth was best predicted from P and K levels. Mortality (2 percent) and incidence of blight infection (<1percent) were too low to provide meaningful contrasts. Relationships between chestnut performance and site characteristics may change as the seedlings overcome transplant shock and allocate more energy to growth.

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[2] USDA Forest Service, 359 Main Rd, Delaware, OH 43015.
[3] USDA Forest Service, 335 National Forge Road, Irvine, PA 16329.
[4] University of Tennessee, 274 Ellington Hall, Knoxville, TN 37996.
[5] Connecticut Agricultural Experiment Station, 123 Huntington St, New Haven, CT 06511.
Corresponding author: corneliapinchot@fs.fed.us.