FLOOD TOLERANCE EVALUATION OF BOTTOMLAND OAKS IN A MULTI-CHANNEL FIELD LABORATORY

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A multi-channel field laboratory was designed and constructed by the University of Missouri Center for Agroforestry at the Horticulture and Agroforestry Research Center to assess the flood tolerance of forages and hardwood seedlings. This facility located in the Missouri River floodplain consists of twelve 6-m wide x 180-m long channels that had minimal disturbance to the old-field riparian soils when soil from the retention pond was used to construct the berms. Each channel can be independently flooded for variable duration to specific depths with either flowing or stagnant water. For this study, we used nine channels arranged in a randomized complete block design of three blocks of three treatments each.

Treatments included five weeks of 15-cm-deep clear stagnant water, five weeks of 15-cm-deep turbid flowing water, and a non-flooded control. In mid-April 2003, we planted 1700 one-year-old, bareroot seedlings of cherrybark oak (*Quercus pagoda* Raf.), water oak (*Q. nigra* L.), willow oak (*Q. phellos* L.), and black walnut (*Juglans nigra* L.) from the University of Tennessee's Tree Improvement Program. Flood treatments were imposed 3 weeks later at the onset of seedling budbreak. Preplanting measurements included individual stem height, basal stem diameter, and number of first-order lateral roots. Ten-month post-planting measurements included survival, origin and length of the basal and apical new shoots, total number and length of new shoot growth, and amount of dieback on taproot.

Survival of all four species was greater in the non-flooded control channels than in either the flowing or stagnant water treatments. Because less than one percent of black walnut seedlings survived the flood treatments, walnut was not included in further analyses. There were no statistical differences in oak survival or growth between the flowing and stagnant water treatments. Willow oak had the best survival (81.4%) followed by cherrybark oak (66.7%), and then water oak (59.9%). Willow oak seedlings produced 3.7 new shoots (many of which were basal sprouts) with an average combined length of 71 cm. In contrast, water oak seedlings produced 2.9 new shoots with a combined length of 52 cm. Growth for both species exceeded that of cherrybark oak which produced 2.8 elongating shoots with a combined length of 19 cm. Approximately 15 percent of the surviving cherrybark oak seedlings exhibited greater than 50 percent dieback of the taproot compared to 21 percent of the willow oak and 26 percent of the water oak seedlings. From these data, we conclude planted willow oaks are more tolerant to prolonged spring flood events at the onset of spring budbreak than are planted seedlings of water oak or cherrybark oak, all of which are more tolerant of flooding than planted black walnut seedlings.