Performance of Four Hybrid Poplars and Three Native Hardwoods in Plantations in Central Virginia at Age 14

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The Bottom Line…

High mortality following successful establishment casts doubt on the viability of these hardwood species as plantation crops in this part of Virginia. Only a Populus trichocarpa x deltoides hybrid showed any promise.

Abstract

Study plots were installed by MeadWestvaco research personnel in Appomattox County in the spring of 1999 to evaluate seven hardwood species or hybrids as potential plantation bioenergy crops. Species tested were sweetgum, yellow-poplar, hybrid aspen (Crandon), and four hybrid poplars: NxM [Populus nigra x P. maximowiczii], TDxM = [(P. trichocarpa x P. deltoides) x P. maximowiczii], TxD [P. trichocarpa x P. deltoides], and TxM [P. trichocarpa x P. maximowiczii]. Loblolly pine was also planted for comparison. Fourteen years after planting, survival and growth differed widely among species and only the one hybrid – P. trichocarpa x deltoides – showed any promise in terms of combined survival and growth (76%, 8.2-inch average dbh, 78-foot average height). To develop a commercially-viable bioenergy crop, more research will be needed to identify site requirements, adaptability, and appropriate management regimes for individual species.

Background

Interest in bioenergy production capacity in Virginia is increasing, and the planting of hardwoods or hybrids is one opportunity that has been discussed as a fiber source. As an alternative to traditional non-renewable fuel sources, bioenergy crops may offer reduced greenhouse gas emissions, increased carbon sequestration, decreased dependence on foreign energy supplies, and potential improvements in economic alternatives for rural economies. In particular, Populus species and hybrids have been studied and identified as excellent options for several areas of the United States. Research has proven that selection of the appropriate species or genotype for specific site conditions can have large impacts on potential productivity.

Methods

In the spring of 1999, MeadWestvaco researchers planted a test of eight tree species – loblolly pine, sweetgum, yellow-poplar, hybrid aspen (Crandon), and four hybrid poplars: NxM [Populus nigra x P. maximowiczii], TDxM = [(P. trichocarpa x P. deltoides) x P. maximowiczii], TxD [P. trichocarpa x P. deltoides], and TxM [P. trichocarpa x P. maximowiczii]. Seedlings were planted in 49-tree plots in a randomized complete block experimental design with four replications on a cutover site located on the Walton Tract in Appomattox County, VA, approximately 3.5 miles south of the James River (37° 29' 48.28" N x 78° 52' 08.07" W). The site was prepared with subsoiling and a broadcast herbicide spray to control competing vegetation in the fall of 1998. In the winter of 2012-2013, VDOF was invited to re-measure the study plots.

Results

The age 14 data are summarized in Table 1. Survival and growth differed widely among species. Sweetgum and yellow-poplar – two species common in central and southern Virginia – survived quite well (99% and 86%, respectively), but didn't grow particularly well. The Crandon hybrid aspen grew better than any other genotype in the trial, but only 37% of them survived at age 14. Loblolly pine – which is widely planted and generally very productive in Virginia – was expected to represent maximum productivity on the site but was instead a failure (likely due to inadequate competition control). Probably the best balance of growth and survival under the conditions in this test was exhibited by the P. trichocarpa x deltoides hybrid, which ranked third in survival and was exceeded only by aspen in individual tree size. It produced the greatest amount of biomass (Figure 1).

In this study, species had a large impact on productivity. Three of the genotypes (TDxM, TxM, and aspen) showed evidence (i.e., large standing dead or broken trees) of delayed mortality indicating poor longer-term adaptability. Septoria musiva is a disease threat shown to affect P. trichocarpa hybrids in the northeastern and central United States. Although we were unable to test for its presence at this site, the observed condition of the TDxM and TxM make it appear a possible cause. In addition, numerous trees were observed with broken stems and appear to have suffered mechanical damage around the time of the derecho that occurred in late June of 2012.

In any case, the delayed mortality following successful establishment casts doubt on the viability of these species as bioenergy crops in this part of Virginia. To develop a commercially-viable bioenergy crop, more research will be needed to identify site requirements, adaptability, and appropriate management regimes for individual species.

Table 1. Average survival, size, and volume of eight tree species evaluated for bioenergy planting in central Virginia fourteen years after planting.

Species*	Survival (%)	DBH (in.)	Height (ft.)	Volume Index (ft.3/acre)
Aspen	37%	8.2	92	450
Loblolly	49%	6.4	46	150
NxM	72%	5.9	60	299
Sweetgum	99%	6.3	54	415
TDxM	6%	6.6	52	26
TxD	76%	8.2	78	762
TxM	55%	6.3	40	165
Yellow-poplar	86%	6.4	60	407

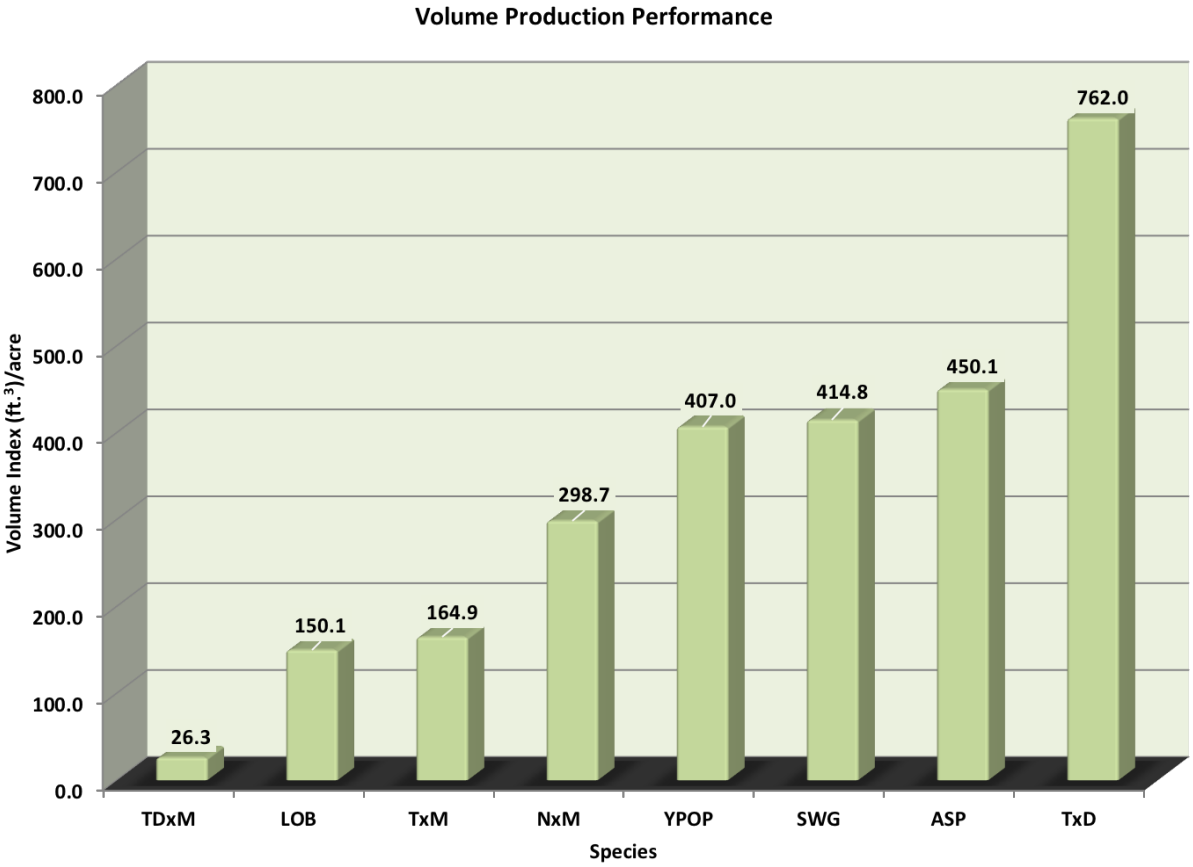

Figure 14. Average 14-year volume production by eight tree species planted in a test of biomass production potential in central Virginia.