

BEST PERFORMING COTTONWOOD AND HYBRID POPLAR VARIETIES IN THE SOUTHEASTERN UNITED STATES: THEIR BASIC SPECIFIC GRAVITY AND MOISTURE CONTENT

Bijay Tamang¹, Victor Steel and Jeff Wright

¹ArborGen Inc, Tallahassee, FL

Cottonwood and hybrid poplars are among the preferred tree species for biomass production due to their fast growth and wide distribution. In the US, they are commonly planted as selected varieties in the Pacific Northwest as well as in the Midwest and Lake States. Trees are usually grown at 1482 trees ha⁻¹ at pulpwood rotations which is usually 6-9 years. In the southeastern US, cottonwood commercial plantations are mostly concentrated along the Mississippi delta region in Arkansas, Louisiana and Mississippi but its range is gradually expanding in the other regions in the southeastern US.

Growth and productivity of cottonwood and hybrid poplars depend largely on genetics, site quality and silvicultural management. In general, productivity in the Pacific Northwest is higher than in the southeastern US as trees are intensively managed under irrigated conditions. In the Pacific Northwest, biomass assessment of hybrid poplar after six and eleven growing seasons show the mean annual increment around 13 MT ha⁻¹ yr⁻¹ (Berguson et al. 2010). Initial estimate for unimproved *Populus trichocarpa* was as high as 21 MT ha⁻¹ yr⁻¹ under two-year coppice rotations (Heilman et al. 1972).

Efforts are underway in the southeastern US to select highly productive varieties with better wood quality, resistance to diseases and suitability to grow across sites. In this report, we evaluate the growth performance of more than 422 cottonwood and hybrid poplar Varietals in the southeastern US and present basic specific gravity and moisture content of the top 30 Varietals.

MATERIAL AND METHODS

Five tests were established between 2003 and 2010 in the states of North Carolina, South Carolina, Georgia and Alabama. All tests were planted using randomized complete design with six replications except the Floyd site which only had four replications. Trees in the tests were measured at the end of 2011 growing season for height and diameter at breast height (DBH). Location of the tests, their genetic composition, age and tree size after the 2011 growing season are given in Table 1.

Since the tests were of various ages, height and DBH measurements were standardized to account for different ages. Standardized volume was estimated using the volume equation developed by Krinard (1983). Best linear unbiased prediction (BLUP) analysis was then done using the standardized data. Varietal S7-C8 was considered the check. Percent height, DBH and volume gain over the check S7-C8 was calculated for each Varietal.

Table 1. Location of tests, age at the time of measurement, no. of Varietals and overall tree size (range in parentheses) after the 2011 growing season:

Test	Age (yrs)	# Varietals	Height (m)	DBH (cm)
Wooten Farm, NC	2	87	4.3 (1.8-5.7)	3.6 (2.0-5.3)
Eastover, SC	4	243	9.1 (3.8-11.5)	7.9 (2.3-13.2)
Moultry, SC	3	161	3.6 (1.7-6.2)	3.0 (0.5-7.4)
Floyd, GA	8	120	17.0 (12.6-21.3)	15.7 (8.9-21.1)
Randolph-1, AL	3	162	5.5 (4.0-7.0)	4.8 (2.8-6.4)
Randolph-2, AL	3	124	5.2 (3.2-7.8)	4.1 (1.8-6.9)

Top 30 best performing Varietals based on volume gain as well as the check, S7-C8, were selected for basic specific gravity and moisture content determinations. Tests at Eastover, Moultry and Randolph were selected for increment core sampling as these were identical in age. Cores were extracted from three ramets per Varietal per test in October/November 2012 using an increment corer. Cores were immediately sealed in ziplock bags with pre-determined weight and stored in a cooler. Weight of the ziplock bags along with the increment cores was taken within three hours after extraction. Increment cores were soaked in water and their volume estimated using the water immersion method. Cores were then oven-dried at 101° C until constant weights were obtained. Core oven-dry weight was used to estimate basic specific gravity and moisture content.

RESULTS AND DISCUSSION

Check Varietal S7-C8 was ranked in the 151st, 24th and 15th positions when sorted by height, DBH and volume gain, respectively. Eight Varietals had at least 10% height gain over S7-C8 and six of them were statistically significant ($\alpha=0.05$). Only five Varietals had more than 10% DBH gain over the check but none of them were statistically significant. There were seven Varietals that had at least 10% volume gain over the check but only two were statistically significant ($\alpha=0.05$).

Average basic specific gravity ranged between 0.294 and 0.404 showing variation across genotypes. Klasnja et al. (2003) reported average basic specific gravity of 0.380 for eastern cottonwood. Specific gravity of *Populus* species in published studies across the globe ranged between 0.260 and 0.500 (Headlee et al. 2013). Our estimates are well within the published range.

Overall average moisture content was highly variable within genotypes ranging from 72% to 169% (dry basis). Average moisture content was also highly variable between genotypes within a site. Since the samples were collected within few hours from each site, the variation could be mainly due to difference in genotype and micro site differences to some extent. One of the other factors for low moisture content in some genotypes could also be due to sampling in late fall as some genotypes tend to go dormant early. Several other studies have also reported low and highly variable moisture content in poplar (Zhang et al. 2003, Pearson et al. 2010)

Acknowledgements: SunGrant Initiative provided financial assistance for the study.

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