

Growth and Photosynthesis Characteristics of an Artificially Regenerated Mixed Hardwood Stand in the Southern USA

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The hardwood forests of the southern U.S. are not naturally composed of single predominant species. The diversity of tree species within these stands is one of the qualities that make them so valuable for multiple use stand management. While many of the best hardwood sites have been planted to pines since the 1950's, some proportion of these pine stands now being harvested may need to be reforested to mixed hardwood stands to achieve desired biological diversity. In February 1994 a mixed hardwood stand consisting 200 seedlings each of *Carya aquatica* (WH), *Fraxinus pennsylvanica* (GA), *Liquidambar styraciflua* (SG), *Quercus michauxii* (SCO), and *Q. pagoda* (CBO) was established on Savannah River Site, New Ellenton, South Carolina, USA. Sweetgum had 14% mortality after one year. Mortality for CBO (16%) occurred during year 2 and year 3. No mortality occurred for any species after four years. All GA and about 92% of SCO and WH lived. Height (Table 1) and diameter (Table 2) growth of SG was most active among all species. At the end of eight years, SG had the greatest mean stem volume with that of GA, SCO and similar to each other (Table 2). Maximal assimilation rate (A) ranged between 7.9 and 14.8 $\mu\text{mol m}^{-2} \text{s}^{-1}$ for these species (Table 3). In December, CBO and SCO maintained an A of 7.6 and 4.5 $\mu\text{mol m}^{-2} \text{s}^{-1}$, respectively, whereas other three species had abscised completely. In 1999, 33% of SG and 8% of GA trees produced seeds. Acornets were spotted on 3 CBO trees during 2001. Factors contributing to growth variations among species will be discussed.

Table 1. Mean height of five hardwood species in an artificially regenerated stand established in February 1994.

	1993	1994	1996	1997	1998	2001
	Nursery, m	Height, m				
CBO	0.61	0.55	0.90	1.64	2.27	4.81
GA	0.93	0.92	1.95	3.07	3.71	5.35
SCO	0.92	0.85	1.32	2.01	2.59	4.68
SG	1.18	0.97	1.84	3.08	3.77	6.93
WH	0.61	0.58	1.07	1.79	2.19	4.00

Table 2. Mean diameter (cm) and volume (cm³) of five hardwood species in an artificially regenerated stand established in February 1994.

	1993	1996	1997	1998	2001	2001
	RCD	DBH Diameter				Vol (D ² H)
CBO	0.71	0.09	0.67	1.66	5.26	18,640
GA	0.93	1.16	2.01	3.09	5.54	18,620
SCO	1.32	0.36	1.17	2.45	5.41	17,120
SG	1.25	1.21	2.90	4.53	8.46	55,100
WH	1.20	0.13	0.78	1.35	3.80	7,520

Table 3. Maximum assimilation rate (A) of five hardwood species in an artificially regenerated stand established in February 1994.

	MAY	JUL	AUG	SEP	NOV	DEC
	Maximum A, $\mu\text{mol m}^{-2} \text{s}^{-1}$					
CBO	11.7	14.2	9.9	10.5	12.2	7.6
GA	11.9	12.6	10.1	11.1	7.9	--
SCO	10.0	13.4	9.9	7.9	11.6	4.5
SG	9.7	14.8	12.8	8.9	7.4	--
WH	10.9	11.1	11.2	11.6	8.1	--