

Comparing the Seedling Growth of Six Precious Species in Southern China

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Abstract

Seedling stage is an important period for forestry. The aim of this study was to estimate the growth trend of six local precious species and consider their implications for silviculture on forestry. We assessed height, diameter near ground and crown width at 1, 4, 6 and 8-month. The variance analysis indicated that there were significant differences between species on all traits except diameter near ground and crown width at 8-month. There were no significant differences on height and crown width at all ages among replicates whereas there were significant differences on diameter near ground at 1 and 4 months, differences on diameter near ground at 6 months and no difference on diameter near ground at 8-month. The significant differences among interaction of species and replicates on diameter near ground at 1-months, 4-month, 6-month and crown width at 8-month were also found. *Dalbergia odorifera* had a higher growth period after 6-month. *Aquilaria sinensis* (Lour.) Spreng, *Swietenia mahagoni* (L.) Jacq., *Hopea hainanensis* Merr. et Chun, *Homalium hainanense* Gagnep. and *Cassia siamea* Lam. had the same growth trend on all traits at the whole time.

Keywords: *Local Species; Precious Species; Growth Traits; Seedling*

1 INTRODUCTION

After 1960s, the launching of large-scale plantation programs was begun in many tropical and subtropical countries and there was a significant increase in the area of plantations for industrial purpose by 2000 [1,4]. As the global population grows and areas of native forest decreases and the protection of natural forests by governments, particularly in developing countries, there are increasing demands for pulp and paper and wood products from tree plantations and agroforestry [2,6,8]. In the past many decade years, China have launched many programs for plantation. The major species include Poplar, Chinese fir, Eucalypts and other species [14-15].

According to the eighth forest assessment, China's forest covers 208 million hectares, about 21.63 percent of the land area and China had biggest plantation in the world which is 69 million hectares. The whole results indicated that both forest mount and quality were increased significantly in the past year. However, demand for paper and wood has grown considerably over the past decade, in line with China's growing economy, and this trend is forecast to continue. Among them, wood supply gap was at least over 50%. Because of the global warming and timber supply deficit, the Chinese Ministry of Forestry has been decided to increase 40 million hectares forest area and 1.3 billion m3 forest growing stock in 2020 compared to 2005.

Among the plantation species, Eucalyptus have experienced an important development and considerable successful improvements due to the fast-growing, well adaptability, short-rotation, excellent wood properties, vigorous hybrids and large natural genetic populations occur [5,11-15]. Eucalypt plantations now cover an estimated area of more than 4.0 million hectares, principally in Guangdong, Guangxi, Hainan Island, Yunnan, Sichuan and Fujian provinces while more than 1.4 million hectares in Guangxi [11]. Unfortunately, most of China's eucalypt plantations are established with germplasm derived wholly from *E. grandis* W. Hill ex maiden, *E. urophylla* S. T.Blake or from hybrids of this two species [3,7,10]. Further eucalypt plantations are harvested the whole trees for pulpwood, artificial

fiberboard, sawlogs, roundwood, veneer, fuel wood and soil which had given rise to many environment argument and discussion, many local governments have begun to prohibited Eucalyptus plantation.

Considering the above problems, many provinces in China have started to encourage companies and personal to plant precious and local species for wood use. For one thing, this model could keep abundant forest diversity and improve environment. For another, these species could provide a lot of wood for furniture and other directions. Among the species, *Aquilaria sinensis* (Lour.) Spreng, *Swietenia mahagoni* (L.) Jacq., *Hopea hainanensis* Merr. et Chun, *Dalbergia odorifera*, *Homalium hainanense* Gagnep. and *Cassia siamea* Lam played an important role in Southern China.

Forest trees, unlike livestock or crops, have a longer life span and take a long time to be replaced and the expression of genes in relation to age ^[1,2,9] and competitive environment is likely one of the most important features to consider in seedlings. Therefore, the objectives of this study were to compare the seedling growth on six local precious specious and this information will be used to develop appropriate strategies for silviculture.

2 MATERIALS AND METHODS

The trial was established in the Wanggang village, Tianhe distinct, Guangzhou city (23°13'07"N, 113°21'51"E, Alt 39m). This location is affected by the north tropical monsoon, with an annual mean temperature of 18.8°C and an annual mean rainfall of 1800 mm. Six local precious species seedlings were tested including *Aquilaria sinensis* (Lour.) Spreng, *Swietenia mahagoni* (L.) Jacq., *Hopea hainanensis* Merr. et Chun, *Dalbergia odorifera*, *Homalium hainanense* Gagnep. and *Cassia siamea* Lam. After collected the seed, these species have been sowing in the prepare soil. These seedlings were planted in black bags (11cm×7cm) for 3 to 5 months when they were 3 to 5 cm. All the seedling growth in the black bags were moved into bigger white non-woven fabrics bags (13cm×10cm) for measuring height (H), diameter near ground (D) and crown width (CW) at 1 month, 4 months, 6 months and 8 months. Every species was measured by 300 individuals which were distributed in 10 replicates. The mean crown width was calculated and measured from two directions (south to north and west to east).

3 RESULTS

3.1 Variance Analysis Studied Traits at Different Ages

The variance analysis of studied traits at different ages were presented in Table 1. The results showed that there were significant differences between species on all traits except D and CW at 8-month, implying the differences of D and CW were ranged from significant difference at 1-month to no difference at 8-month. The variance analysis also indicated that there were no significant differences on H and CW at all ages among replicates whereas there were significant differences on D at 1 and 4 months, differences on D at 6 months and no difference on D at 8-month. There were significant differences among interaction of species and replicates on D at 1-months, D at 4-month, D at 6-month and CW at 8-month implying interaction could affect the D traits.

TABLE 1 VARIANCE ANALYSIS OF STUDIED TRAITS AT DIFFERENT AGES

Ages	Traits	Species		Replicates		Species× Replicates	
		F	P	F	P	F	P
1-month	H	43.41	< 0.0001	1.79	0.1820	2.56	0.1100
	D	13.57	0.0003	8.08	0.0046	16.51	< 0.0001
	CW	19.77	< 0.0001	1.18	0.2780	1.89	0.1690
4-month	H	97.24	< 0.0001	0.76	0.3830	1.55	0.2140
	D	35.56	< 0.0001	7.80	0.0054	15.18	0.0001
	CW	6.78	0.0095	1.24	0.2663	1.74	0.1872
6-month	H	100.20	< 0.0001	0.80	0.3730	1.12	0.2900

8-month	D	18.12	< 0.0001	6.41	0.0116	15.34	0.0001
	CW	16.78	< 0.0001	3.22	0.0731	5.75	0.0169
	H	109.5 ₁	< 0.0001	0.63	0.4280	0.01	0.9370
	D	0.36	0.5510	0.67	0.4110	0.04	0.8490
	CW	4.86	0.0278	0.02	0.9008	0.28	0.5918

3.2 Age Trend on Growth Traits of Different Species

The mean value of studied traits for different species were list in Table 2 and Figure 1. The *Homalium hainanense* had highest H at 1-month whereas *Dalbergia odorifera* became the highest H at 8-month and D also showed the same trend indicating *Dalbergia odorifera* had a higher growth period after 6-month. The other five studied species showed the same growth trend on all traits at the whole time and all the species had same growth trend on CW.

TABLE 2 MEAN VALUE OF STUDIED TRAITS FOR DIFFERENT SPECIES

Species	1-Month			4-Month		
	H(cm)	D(mm)	CW(cm)	H(cm)	D(mm)	CW(cm)
AS	24.85	3.22	7.52	27.86	3.52	11.84
DO	54.99	6.19	11.86	59.83	6.52	15.87
HHG	51.80	5.58	9.39	58.57	6.40	14.54
HHM	66.76	7.35	12.26	72.18	7.70	16.65
CS	30.08	4.11	10.62	36.85	4.54	15.58
SM	24.97	4.93	10.54	28.07	5.47	15.59
Average	42.48	5.26	10.39	47.87	5.77	15.01
Species	6-Month			8-Month		
	H(cm)	D(mm)	CW(cm)	H(cm)	D(mm)	CW(cm)
AS	30.80	4.49	14.51	35.12	5.67	19.21
DO	68.76	7.57	19.46	94.67	19.97	22.39
HHG	62.22	7.35	18.08	71.30	8.27	23.61
HHM	77.64	8.12	19.82	84.56	9.08	25.24
CS	41.00	5.10	18.82	50.34	7.57	24.01
SM	31.59	6.78	18.61	37.60	8.97	24.84
Average	52.80	6.67	18.21	63.19	10.10	23.22

Notes: AS: *Aquilaria sinensis* (Lour.) Spreng, SM: *Swietenia mahagoni* (L.) Jacq., HHM: *Hopea hainanensis* Merr. et Chun, DO: *Dalbergia odorifera*, HHG: *Homalium hainanense* Gagnep., CS: *Cassia siamea* Lam.

4 CONCLUSION

In the present study, the mean value and variance analysis of the studied traits were examined. In addition, the growth trends of studied species were evaluated. The current study indicated three implications for seedling growth. Primarily, there were significant differences on diameter near ground at early ages and then no differences at 8-month. Secondly, the interaction of species and replicates could affect the height. Thirdly, *Dalbergia odorifera* had a higher growth period after 6-month. *Aquilaria sinensis* (Lour.) Spreng, *Swietenia mahagoni* (L.) Jacq., *Hopea hainanensis* Merr. et Chun, *Homalium hainanense* Gagnep. and *Cassia siamea* Lam. had the same growth trend on all traits at the whole time.

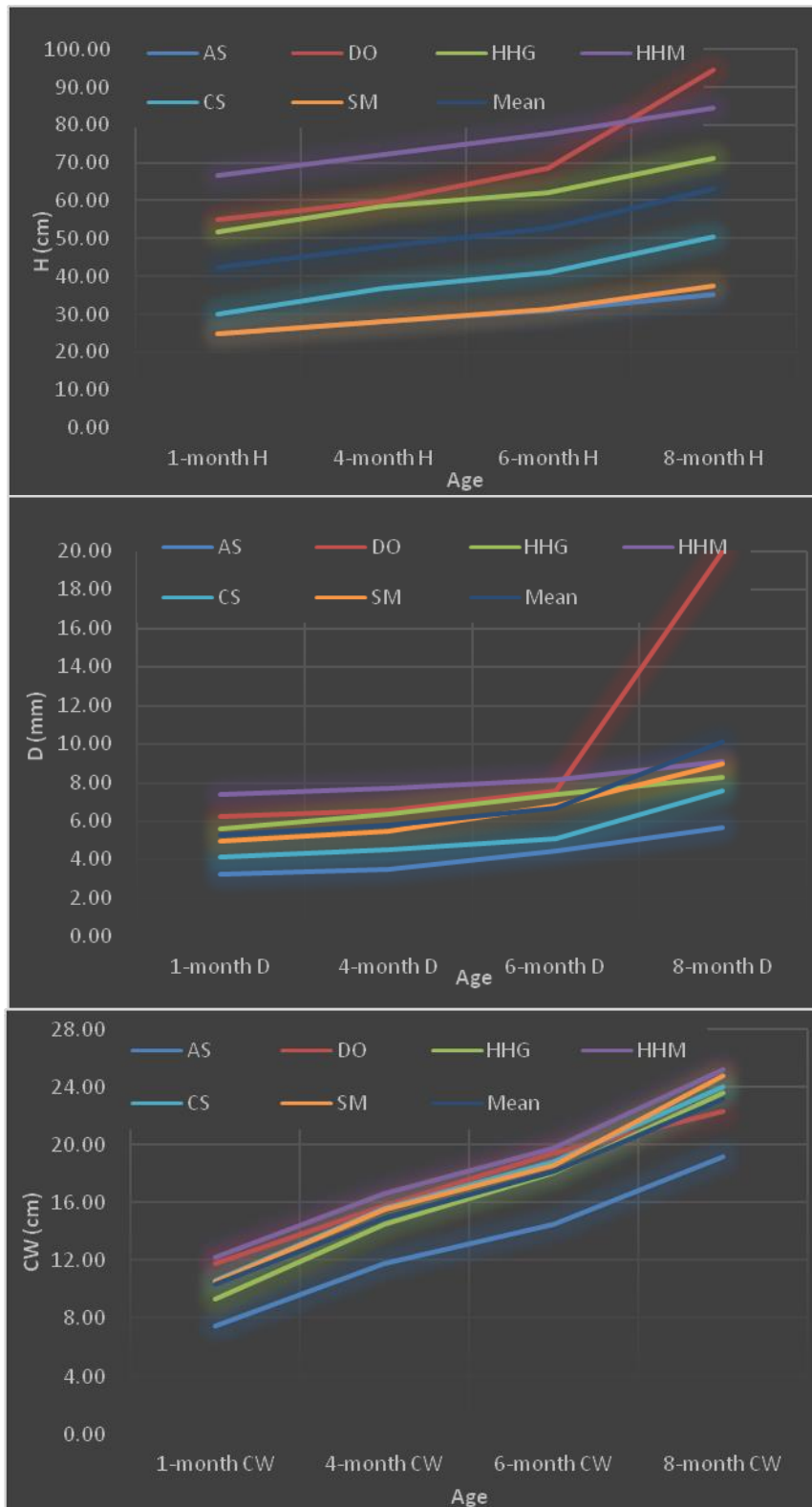


FIGURE 1 THE TREND OF STUDIED MEAN TRAITS AT DIFFERENT AGES

Notes: AS: *Aquilaria sinensis* (Lour.) Spreng, SM: *Swietenia mahagoni* (L.) Jacq., HHM: *Hopea hainanensis* Merr. et Chun, DO: *Dalbergia odorifera*, HHG: *Homalium hainanense* Gagnep., CS: *Cassia siamea* Lam.

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