GROWTH MODELING OF GENETICALLY IMPROVED SLASH PINE

H. Zhang and D.L. Rockwood [1]

Four growth and yield studies in Florida and Mississippi provide insights into the dynamics of stand development for genetically improved slash pine under different deployment strategies. Total Height, Height to live crown and DBH were measured at 15 years of age in 1997-1999 (Table 1).

Table 1. Description of slash pine growth and yield studies

Study No.	Estab. Location	Estab. Date	Site Type	No. of Progenies	Measurement Ages
0-509	Hampton, FL	1983	Flatwoods	21+ UC	1, 5, 9, 11, 15
0-511	Perry, FL	1983	Flatwoods	22 + UC	7, 9, 15
0-513	Saucier, MS	1984	Lower coastal plain	10 +UC	2, 3, 5, 9, 15
0-516	Pearl River, MS	1985	Lower coastal plain	10 +UC	1, 2, 6, 9, 15

To model these stand developments through 15 years, the three-parameter Weibull distribution function:

$$f(x) = (c/b) * (((x-a)/b)`-i) * exp\{ - (((x-a)/b)`)\}$$

was applied, to data for several planting mixes (10% row or mix plots; 25% / 75% mix of two progenies; 100%) and progeny (10 improved slash pine progenies and one unimproved checklot) combinations. In the Weibull distribution, the location parameter 'a' indicates the smallest possible DBH, the scale parameter 'b' reflects the spread of the distribution. The larger 'b' value in one distribution means the more variability. The shape parameter 'c' controls the symmetry of the distribution. Distribution is approximately normal when c=3.6. Simple percentile procedure was used to estimate the parameters of Weibull Distribution. The estimated coefficients from these models were then used as dependent variables in analyses of variance to investigate the effects of planting mix and progeny.

Progenies had significant effects on all three coefficients (location, scale, and shape) at each age. Figure 1 compares the DBH distribution of progenies 7056 and 18358. Progeny 7056 had a larger 'a' parameter, but smaller 'b' parameter. This provides us a criterion to select the progenies according to their DBH distribution behavior. As age increased, the location and scale parameters also increased, so the DBH distribution shifted to the right and had more variability as shown in Figure 2.

Density had significant effect on DBH distribution. Figure 3 shows that compared to wide spacing, narrow spacing has smaller 'a' and 'b' parameters. Although Figure 4 indicated that planting mix level doesn't change the overall means of DBH very much, it does cause the difference of distribution. It significantly influenced all three parameters at each age. Compared to 100% pure plots, 10% mixes had larger location parameter, but the scale and shape parameters were smaller (Figure 5). The smaller 'b' parameter indicated that overall DBH mean of 10% mixes didn't differ from 100% pure plots although it had the larger 'a' parameter.

[1]School of Forest Resources and Conservation, University of Florida, Gainesville, FL, 32611-0410

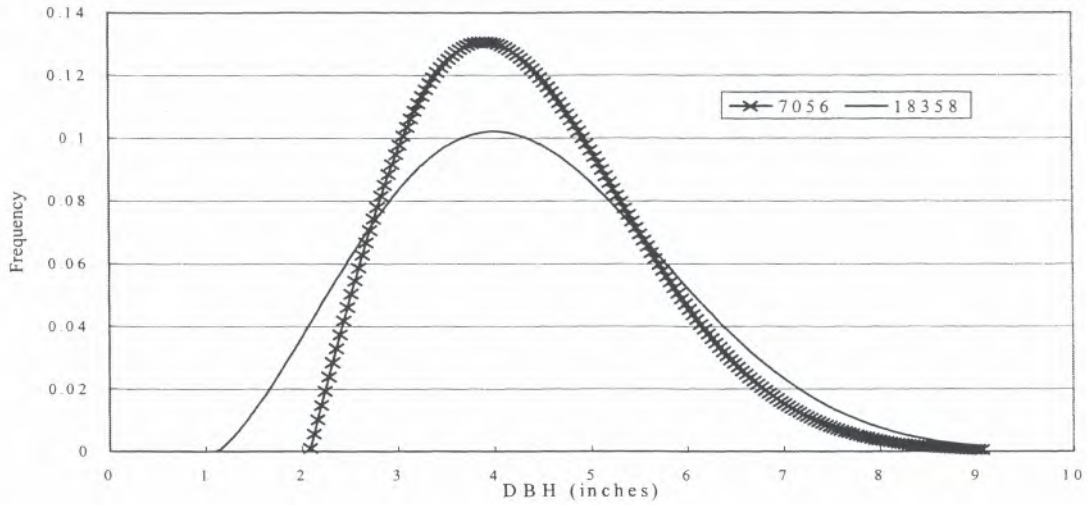

Figure1. Influence of progeny on DBH Distribution at age 15 at Perry

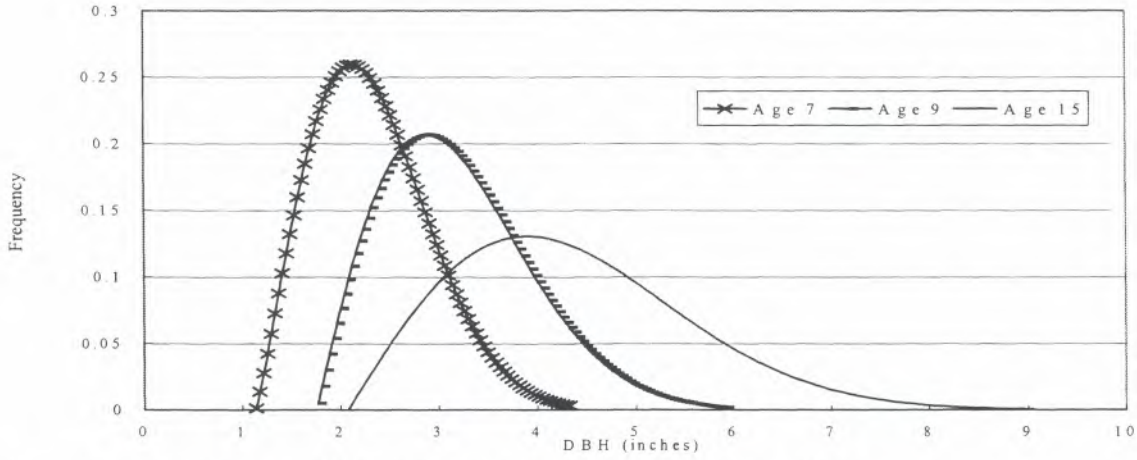

Figure 2. Influence of age on DBH distribution for progeny 7056 at Perry

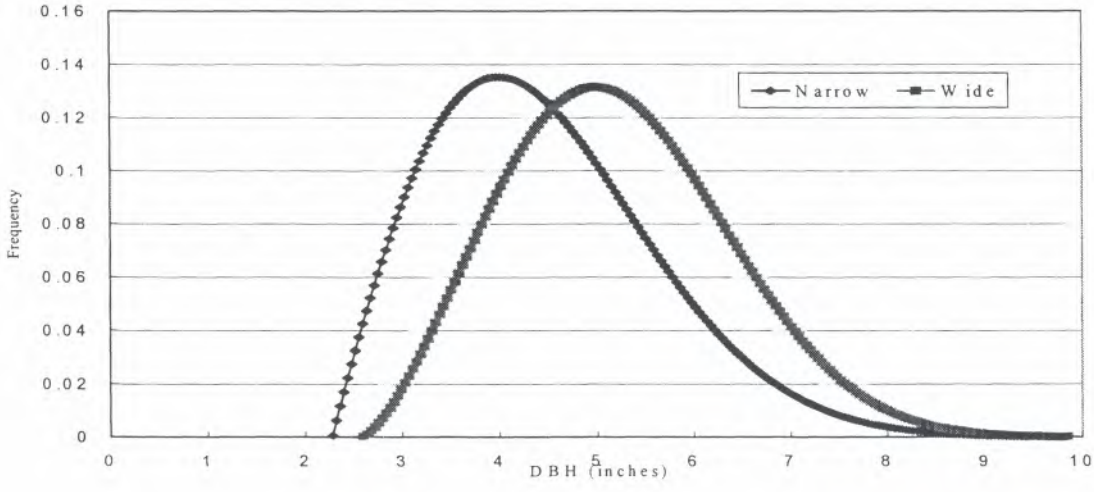

Figure 3. Influence of density on DBH distribution.

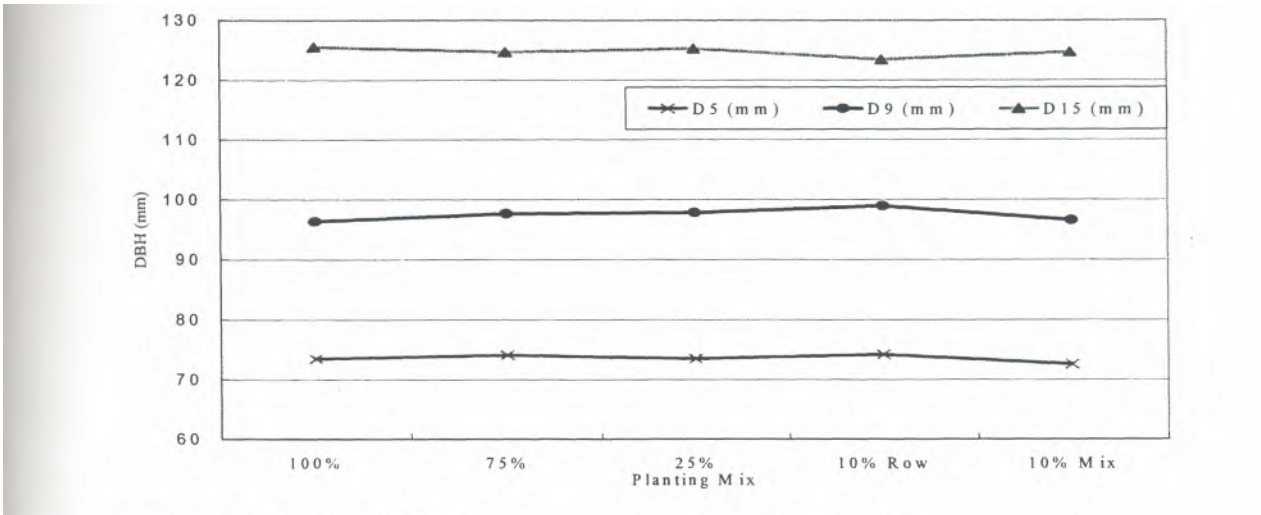

Figure 4. Mean of DBH for different planting mix levels in Saucier, MS

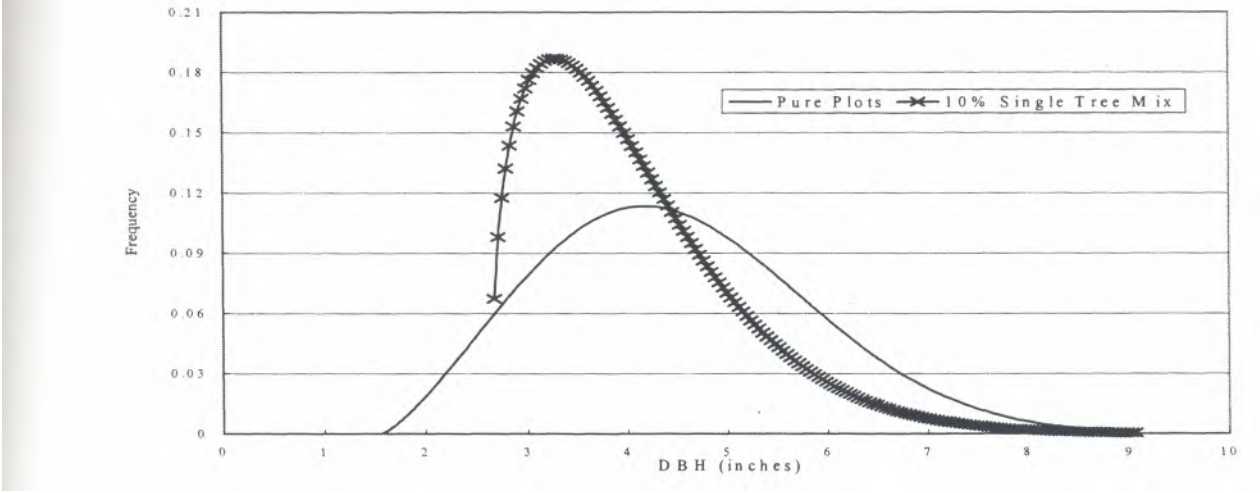

Figure 5. Influence of planting mix on DBH distribution of 13 progenies at age 15 at Perry.

Keywords: *Pinus elliottii* var. *elliottii,* growth and yield, genetic improvement, Weibull Distribution

LITERATURE CITED

Rockwood, D.L., B. Yang, and H. Gresham. 1995. Growth models for slash pine families. In: Proc. 23rd. South. For. Tree Improvement Conf., June 19-22, 1995, Asheville, NC. p. 16-23.

Spirek, F.J., L.G. Arvanitis, D.L.Rockwood, and R.C. Littell. 1981. Modeling diameters and heights of improved slash pine using Weibull distributions. In: Proc. 16 th South. For. Tree Improvement Conf., pp. 47-54.

Zanakis, S.H. 1979. A Simulation Study of Some Simple Estimators for the Three-Parameter Weibull Distribution. In: J. Statist. Comput. Simul. Vol. 9, p. 101-116.