

# LOBLOLLY GENETICS:

## PERFORMANCE AND VALUE IN A 20-YEAR-OLD PLANTATION

### ADVANCED GENETICS DELIVERS ADDED VALUE TO FOREST LANDOWNERS IN THE FOLLOWING CASE STUDY.

BY RAFAEL DE LA TORRE AND W. PATRICK CUMBIE

Southern pine landowners now have it all. Whereas in the 1980s and 1990s, forest products corporations had the best genetics, the best research data and the financial analyses to grow high productivity plantations, private landowners and their consultants now have access to all three.

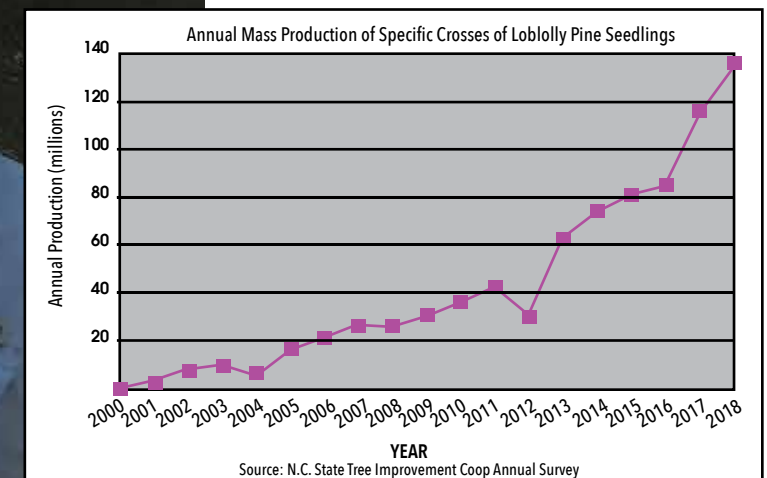
The following report provides the oldest data on advanced, hybrid seedling genetics in existence giving validation of long-term gains in yield and financial return.

Since 2009 the amount of advanced loblolly pine genetics has been steadily increasing in the southeastern U.S. seedling market. As of 2017, the more than 680 million full-sib seedlings have been planted in the southeastern United States, which accounts for approximately 15 percent of the annual loblolly pine seedling market (Fig. 1 below & Mckeand, 2017).

Observing and verifying financial value produced in a forest plantation is a long-term endeavor, and there are few documented examples that demonstrate how the genetics of seedlings has impacted stand value over a rotation. The genetic options available to landowners today vary widely in their productivity, log quality and associated financial gains.

While there has been a tremendous effort

Co-author Patrick Cumbie stands alongside an impressive four-year-old stand of loblolly in South Carolina.



made to communicate the value that advanced genetics offers forest landowners, there still

A stand of two-year-old MCP in Georgia. The number of advanced loblolly pine genetics has been steadily increasing in the Southeast in recent years.



are many landowners unaware of the benefits that come from selecting seedlings with superior genetics. A long-term trial established initially by MeadWestvaco in the South Carolina Lowcountry offers an excellent opportunity to see the potential value offered by planting elite loblolly pine hybrid genetics.

A *Forest Landowner* magazine article by Steve McKeand (November/December 2017 issue) highlighted the genetic options available to landowners, and a few points are relevant as we look at the results of this 20-year-old trial. From the North Carolina State University Cooperative Tree Improvement program's coastal population, the majority of top-ranking families are full-sib hybrids among specific female and male parents.

Out of the top 100 families for volume growth, 95 are full-sibs. Log quality and disease resistance are even more dramatic with nearly 200 to more than 500 full-sib families exhibiting better performance for straightness, reduced forking, and rust resistance. From progeny test field trials we see there is a tremendous potential for superior performance by deploying control-pollinated full-sib seedlings (CP) over traditional open-pollinated (OP) seedlings. Let's see what a comparison of families in this well-designed study looks like after 20 years.

### A TWENTY-YEAR-OLD STUDY OF ADVANCED GENETICS

In a previous *Forest Landowner* magazine article (September/October 2013 issue) we presented the results from this study at age 12 years following a thinning. Briefly, the study was established in 1998 in South Carolina's Berkeley County. The previous stand exhibited a site index (base age 25) of 78 feet. Three open-pollinated families were planted along with two full-sib families (a.k.a. MCP® & CMP) in 64 to 72 tree blocks with four replicates of each family, but we will report only on the two most relevant families for this report.

The study was periodically measured from age 4 to age 20 years. Since age 12, both growth and stem quality have been assessed. Log quality for each tree was assessed by evaluating for defects such as stem fusiform rust stem galls, excessive sweep and stem forks. All of these traits were combined into a single quality score called "SawTimber potential" (STP) (Cumbie, 2012).

### A LOOK AT AGE 20 RESULTS

Full-sib family CP-1 had the greatest growth rate in the trial and a significantly higher proportion of sawtimber quality trees both before and after thinning (Table 1). Family CP-1 is exhibiting a growth rate of 8.3 green tons/acre/year compared to the OP1 family that growing at 6.7 tons/acre/year. The combination of superior growth rate and high quality logs is the basis of the financial returns that are possible with control pollinated, full-sib seedlings demonstrated with this trial.

### AGE 20 YIELD AND STEM QUALITY

After 20 years of growth, all of the families are exceeding the

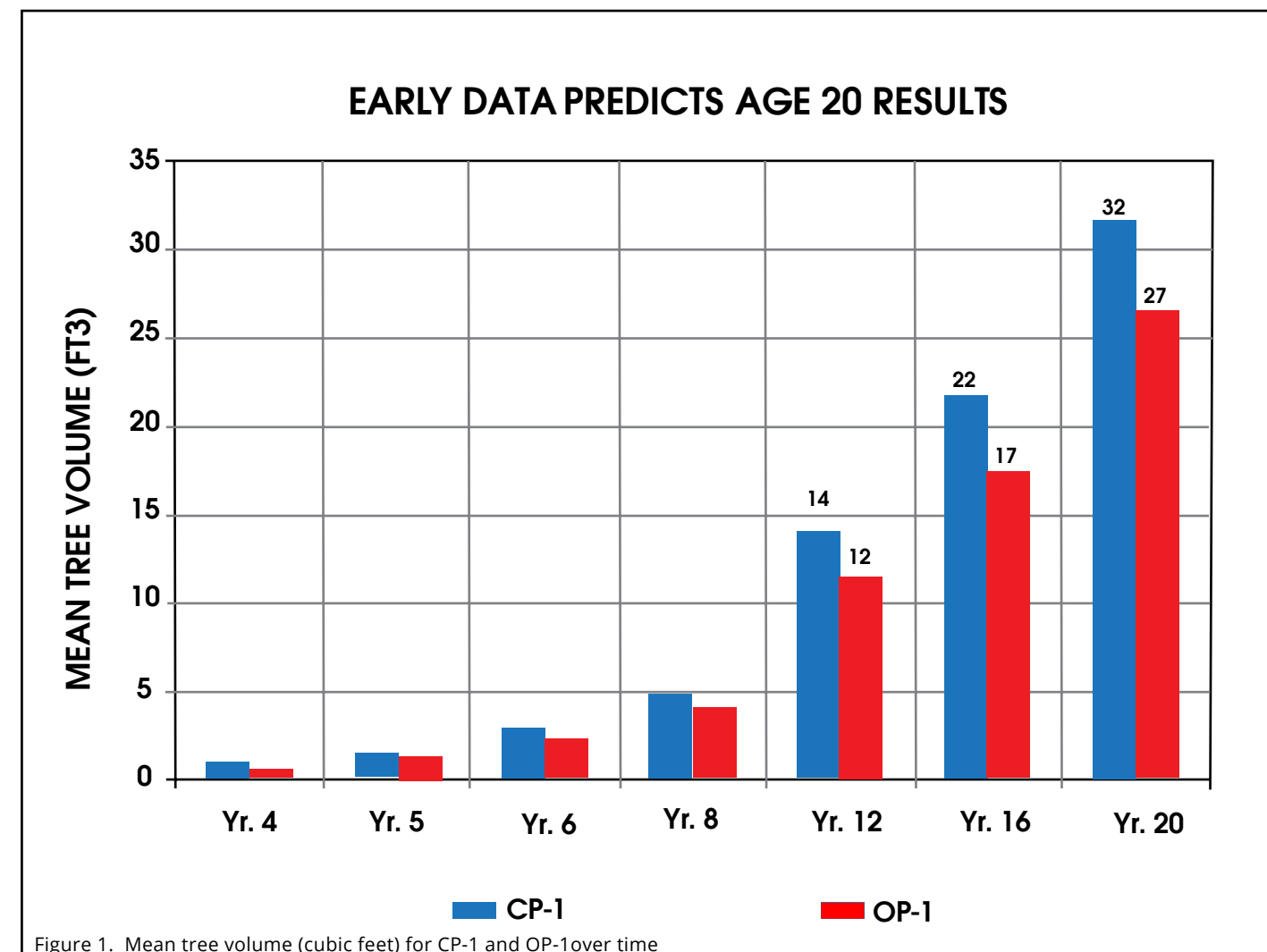


Figure 1. Mean tree volume (cubic feet) for CP-1 and OP-1 over time

previous rotation's site index of 78 feet at base age 25 years. CP-1 is exhibiting a site index of 95 feet compared to OP-1, a widely planted open pollinated family that is exhibiting a site index of 88 feet. On average, CP-1 was 80.9 feet tall at age 20 compared to OP-1 at 73.8 feet. However, because the growth rate is not the only factor creating stand value, log quality traits such as reduced fusiform galls, stem forking, and straightness was measured.

The study data were summarized to build stand tables, and these were projected to an economic rotation age of 25 using ForesTech's SiMS 2012 growth and yield simulator.

As we previously reported, after the thinning at age 12, the differences in sawtimber potential became closer among the families, but the OP family had much lower stocking because there had been so many defective trees removed. This high level of defective tree removal thus reduced future volume and value such that thinning will not make a lower end genetics seedling as good as an elite genetics seedling stand.

We observed that OP-1 improved from 53 percent to 80 percent STP but there were only 101 trees per acre versus 131 trees per acre of CP1, all of which is now sawtimber. Using the

age 20 inventory, we classified trees into sawtimber, chip-n-saw, and pulpwood. CP-1 produced the most sawtimber with 84 percent while OP-1 had the least sawtimber with 56 percent.

As time passed following the thinning, the families responded to the release and differences in diameter at age 20 were not as dramatic. However, substantial height differences did continue with CP-1 showing superior height and volume growth over time. At age 20, eight years after thinning, CP-1 has maintained a 7-foot height advantage and a 19 percent tons per tree advantage compared to OP-1.

Combining the per tree growth gains with the higher number of sawtimber logs after thinning, CP-1 has 46 percent more tons of wood (116 tons) per acre compared to OP-1 (80 tons). At age 12 we also observed that OP-1 was left with only 48 ft<sup>2</sup>/ac of basal area compared to 70 ft<sup>2</sup>/ac in CP-1. The age 20 results reflect a similar difference as CP-1 has increased to 108 ft<sup>2</sup>/ac and OP-1 is at only 83 ft<sup>2</sup>/ac, roughly the same difference in basal area that was observed after thinning at age 12.

One interesting point to highlight is that young stand data has predicted the superiority of CP1 over OP 1 at age 20. Periodic measurements were taken on these two families beginning

Geoff Hill, reforestation advisor for Arborgen, stands in a 28-month-old loblolly stand that already has reached 12 feet in height.

Genotype	Thin: YR 12 tons/ac			Clear-cut Yr. 25 tons/ac			NPV \$/ac	Total IRR(%)	Revenue (\$/ac)		
	PW	CNS	Cull*	PW	CNS	ST+P			Thinning	Clear-cut	Total
OP-1	12	20	25	26	43	42	462	10.5%	678	2,431	3,109
CP-1	5	37	8	28	38	91	745	11.2%	726	3,886	4,611

\*Assumes current log prices

Table 2. Summary of Product Yields\* (tons/ac) and Financial Metrics (\$/ac, %) for a projected harvest at age 25.

at four years of age. In figure 1 we see that by eight full-sib family CP-1 was exhibiting greater volume growth compared to OP-1 which has continued through the life of the stand.

### THE BEST GENETIC PERFORMANCE YIELDS THE BEST FINANCIAL RETURNS AT AGE 25

Table 2 contains yields, Net Present Value (NPV) and simple revenues for the genotypes in this study using today's log prices. OP1 and CP1. Against the benchmark family, OP-1, the CP-1 family had an increase of NPV of \$283 per acre or a 61 per-

cent increase. This resulted in an expected revenue difference at clearcut of \$1,454/acre for the 25-year rotation. Family CP-1 generated higher returns compared to all other families in the trial and these substantial financial gains were achieved with a modest cost increase of \$55 more per acre for the CP-1 versus OP-1 and resulted in a 15 percent rate of pretax return.

### CONCLUSIONS

Landowners now have access to the best genetics, field trial data and financial performance information to allow them to

be confident in their seedling genetic investment. Advanced genetic products such as control-pollinated full-sib seedlings offer additional value over traditional OP seedlings even using today's log prices. This 20-year-old trial in the lower coastal plain of South Carolina provides insight into the performance of this hybrid, control pollinated genetics demonstrating the growth and financial gains that are possible in loblolly pine plantations.

Control pollinated family CP1, demonstrates the value of advance genetics that comes from genetic testing and development with a 61 percent increase in NPV and a 60 percent increase in revenue at final harvest over family OP-1. The exciting news for landowners is that seedlings with these same genetics are available today for private landowners and

consultants across the southeastern United States.

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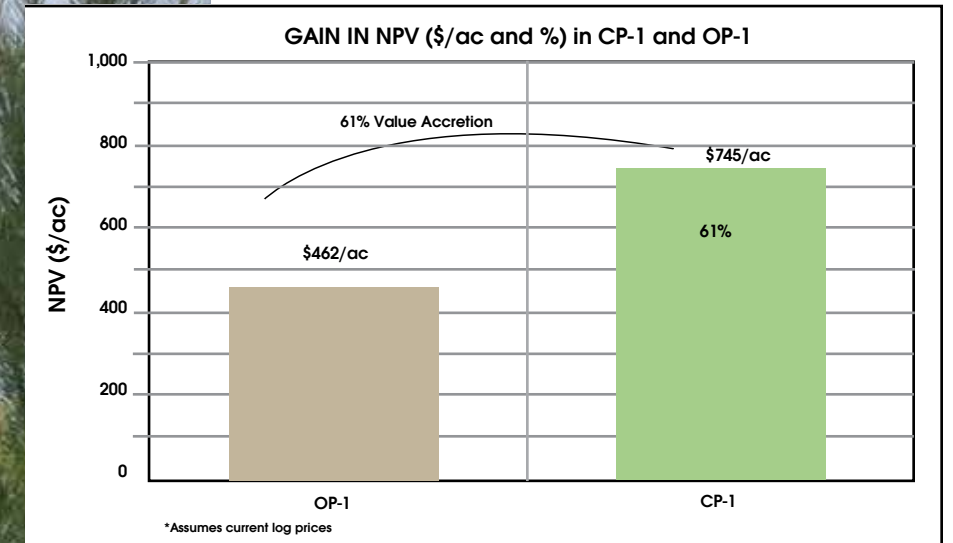


Figure 2. Full-sib family CP-1 more than 60% value increase over OP.

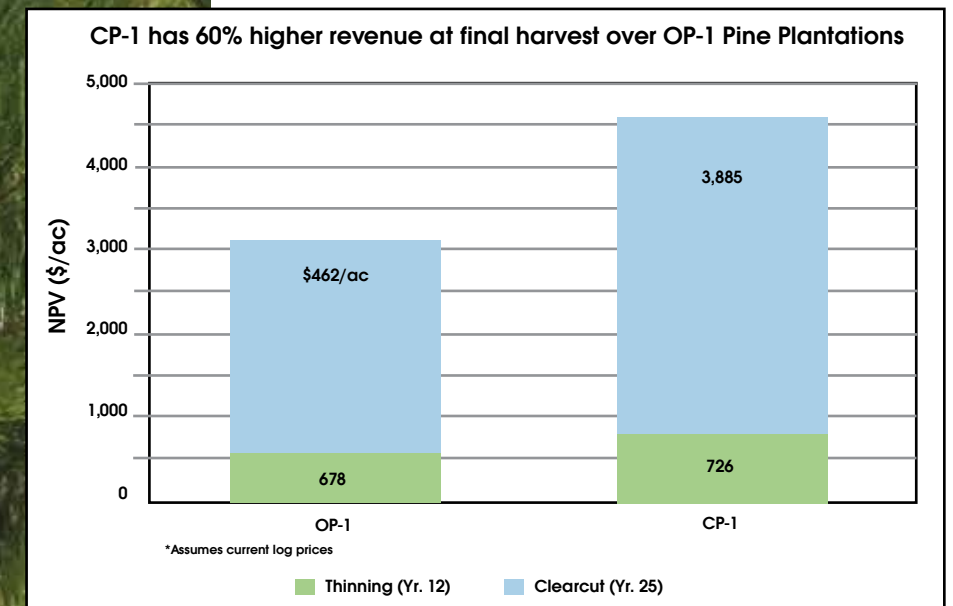


Figure 3. Thinning and final harvest revenues between Full Sib Family CP1 and open pollinated family OP1 (\$/ac @ rotation age, Yr. 25).