Pine Seedlings for Increased Revenue for Private Forest Landowners

Southern pine markets have shifted away from the pulp and paper industry and gradually more toward sawtimber. This change began in the mid- to late 1990s as offshore pulp and paper mills in Brazil and other countries began production in a significant fashion, capitalizing on the ability to use a single species, lower growing costs, and lower labor costs. As a result, a significant number of pulp and paper mills in southern states closed.

The pulpwood markets along the United States Atlantic and Gulf coastal areas and in Europe take advantage of the need for early pine thinnings, which reduce the number of stems, allowing better growth for the remaining trees. These first thinnings in pine plantations are designed not only to reduce the number of trees per acre but also to remove trees that exhibit some obvious defect such as forking, disease, or crooked stems. Unfortunately, this is rarely accomplished, as many times these first thinnings remove rows to lower the number of trees per acre with no regard to quality.

Nonindustrial private forest (NIPF) landowners in the South have willingly embraced pine plantation culture and have come to expect good financial returns from each harvest made in these plantations. However, management of these plantations, for the most part, lacks the intensity typically practiced by the timber industry. While most NIPF landowners are willing to do a limited amount of site preparation work and some first-year herbaceous competition control, they generally do not know what type of seedlings they should plant, especially when markets have become limited in specific areas.

In general, NIPF landowners think that second-generation open-pollinated planting stock is just as good as any other available stock type, and they are probably not fully aware that there are alternative seedling types that could result in increased revenue. One reason for this is the cheaper cost of open-pollinated seedlings, which currently ranges from $60 to $85 per thousand, and the continual practice of planting greater than 600–700 seedlings per acre. With this strategy, the landowner would expect to pay a total of $87 to $110 per acre ($42 to $56 per acre for seedlings and $45 to $53 per acre for contract planting). However, in many instances, landowners would certainly benefit from purchasing the best genetic seedlings available, even it meant paying a slightly higher price.

There is no doubt that the second-generation loblolly pine population has demonstrated considerable gain over the first generation. However, today there are a number of different genetic seedling stock types, including both mass control-pollinated (MCP) and varietals (clones). These genetic types have the specific advantage of being able to express more of their genetic potential over that of open-pollinated seedlings. Unfortunately, there is a lack of reliable information on productivity and quality of different genetic seedling types that would allow NIPF landowners and consultants to make informed decisions on what specific family is the best available genetic planting stock.

To make this type of decision, it is best to clearly understand the terms used to describe a specific genetic type of material.

- **Open-pollinated seedlings (OP)**: These types of seedlings result from natural wind pollination. Pollen could come from trees found in the orchard or from unimproved trees outside of the orchard. Open-pollinated seedlings are available from first-, second-, or third-generation orchards.
- **Mass control-pollinated seedlings (MCP)**: Female flowers of a selected mother tree are physically isolated, and pollenated with a select male parent. The parent trees are chosen because their specific combination is known to produce high-quality offspring.
- **Family**: Seedlings grouped by their known genetic background. Open-pollinated families are designated by the known mother (female) tree as the pollen parent is unknown and are referred to as half-sib families. In mass control-pollinated families, both the mother (female) and father (male) are known. These are referred to as full-sib families.
- **Varietal**: Varietals are clones, so they are not referred to as a family but rather as specific individuals or a specific varietal. Each copy of a specific varietal is genetically identical because they are reproduced through vegetative means.

Purpose

A test was established at the North Mississippi Branch Experiment Station near Holly Springs, Mississippi in 2007 to evaluate the difference in growth and form of three different types of genetic planting stock. To do this, six 100-tree block plots of each of the three different genetic types of planting stock (open-pollinated, mass control-pollinated, and varietals) were planted at a 12-by-9-foot spacing on a site that had previously been in pasture. The most significant difference was that the varietal 100-tree block plot consisted of totally different varietals, making comparison to the open-pollinated and mass control-pollinated families very difficult simply due to test design. All of the trees were measured annually through age 4, and then at ages 6 and 8 years. The main purpose of this report is to compare the open-pollinated family to the mass control-pollinated family.

Evaluation

The 8-year measurements began to reveal some interesting differences between second-generation open-pollinated and mass control-pollinated genetic stock. Survival differences were primarily the result of seedling differences that are more likely due to unknown nursery and test site effects, rather than genetic differences of the seedlings. Very little difference in age-8 survival was shown between the open-pollinated (93.5 percent) and the mass control-pollinated seedlings (93 percent).

The major difference between the open-pollinated and mass control-pollinated genetic types is in their height. However, this difference did not show up until age 8. At ages 4 and 6, mean heights between the two genetic types were nearly the same. However, by age 8, the height difference nearly doubled. Correspondingly, a comparison of average tree volume between the genetic types revealed an increasing difference, with the mass control-pollinated trees increasing faster than the open-pollinated trees. When all the trees within each genetic type are examined, it is clear that the open-pollinated type is more variable for both age-8 diameter and height. Not only does the mass control-pollinated family demonstrate greater mean size, but it also shows greater uniformity than the open-pollinated family, with all of the mass control-pollinated trees grouped into the larger classes (**Figures 1** and **2**).

The open-pollinated genetic type exhibited trees in the 4-, 5-, and 6-inch diameter classes, whereas the mass control-pollinated type showed no individual trees below the 6-inch class and very few individuals in the 6-inch diameter class (**Figure 1**). The highest percentage of trees for both the mass control-pollinated and open-pollinated types fell in the 31–35 feet height class, but the mass control-pollinated type had a larger proportion of individuals in this class as well as in the 36–40 feet height class. The open-pollinated type had a greater number of individual trees falling into the lower height classes as compared to the mass control-pollinated family (**Figure 2**).

Differences were evident among the six planting blocks. In blocks 1 and 2, the total plot volume of the open-pollinated family was almost identical to the mass control-pollinated family. However, for blocks 1 and 3–6, the total plot volume of the mass control-pollinated family exhibited a significantly greater plot volume production than the open-pollinated family (**Figure 3**).

The superior performance of the mass control-pollinated family over the open-pollinated family in blocks 3–6 demonstrates the ability of the mass control-pollinated family to express its greater genetic potential when combined with better silvicultural treatments. Blocks 1 and 2 were heavily influenced by Bermudagrass competition, which was insufficiently controlled by site preparation and first-year herbaceous treatments. This lack of control resulted in nearly identical growth between the two genetic types in those two blocks. Thus, the performance of all of the trees suffered regardless of the genetic type. This illustrates the importance of good management, including vegetation control, to realize the better productivity of advanced genetic planting stock.

Unfortunately, it was impossible to compare the varietal plots to the open-pollinated or mass control-pollinated plots because the varietal plots consisted of 56 different varietals. However, results showed that some varietals express excellent growth rates. Examination of the best three varietals showed that they exceeded the growth of both the open-pollinated and mass control-pollinated genetic types (**Table 1**).

In this test, three varietals demonstrated excellent survival and growth compared to the mean of the second-generation open-pollinated family. However, the age-8 performance of these three varietals was similar to that of the mass control-pollinated family.

Questions remain as to whether varietals, typically costing 32–43 cents per seedling, are worth the extra cost compared to second-generation open-pollinated (which cost 6–8 cents per seedling) or mass control-pollinated seedlings (12–18 cents per seedling). Before those questions can be answered, quality characteristics, which will provide added value to the landowner, need to be considered. All three—second-generation open-pollinated, mass control-pollinated, and top three varietals—graded out very similarly in quality, with about a 14 percent degrade. While varietal 288 was not among the top three growing varietals, it also demonstrated excellent

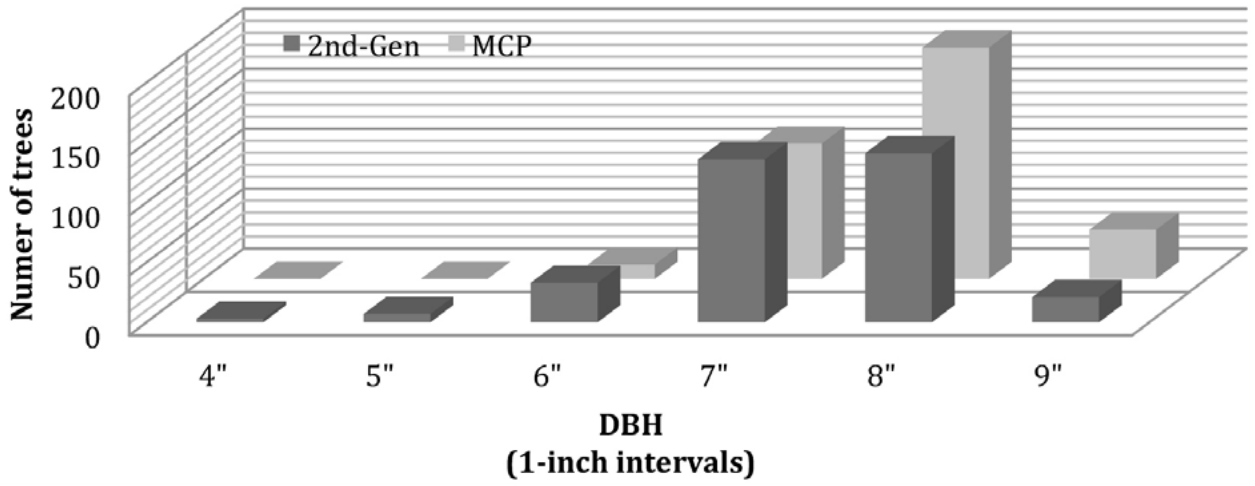

Figure 1. Frequency of individuals for age-8 DBH second-generation and mass control-pollinated loblolly planting stock.

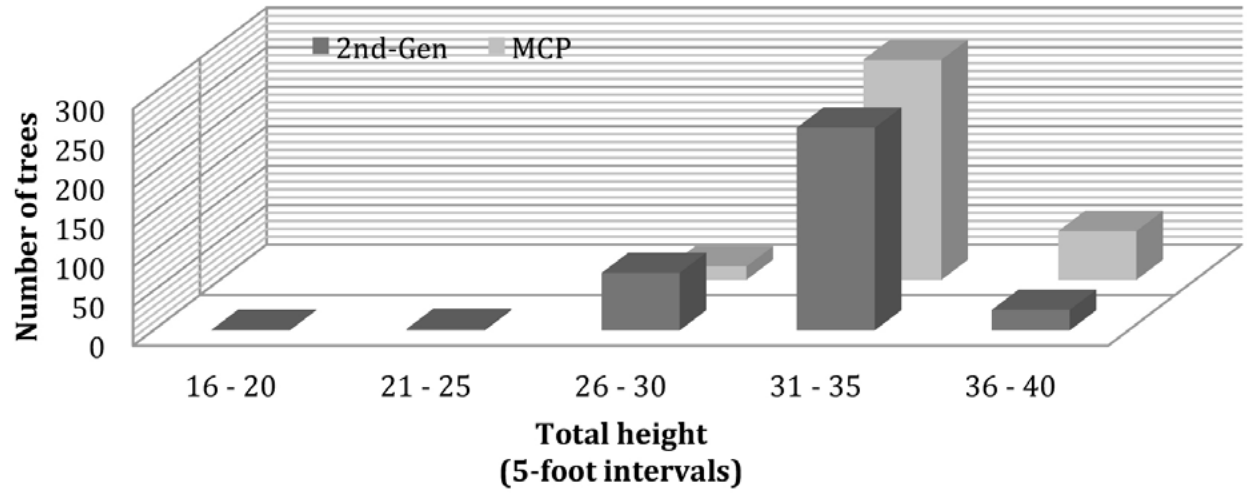

Figure 2. Frequency of individuals for age-8 height of second-generation and mass control-pollinated loblolly genetic types.

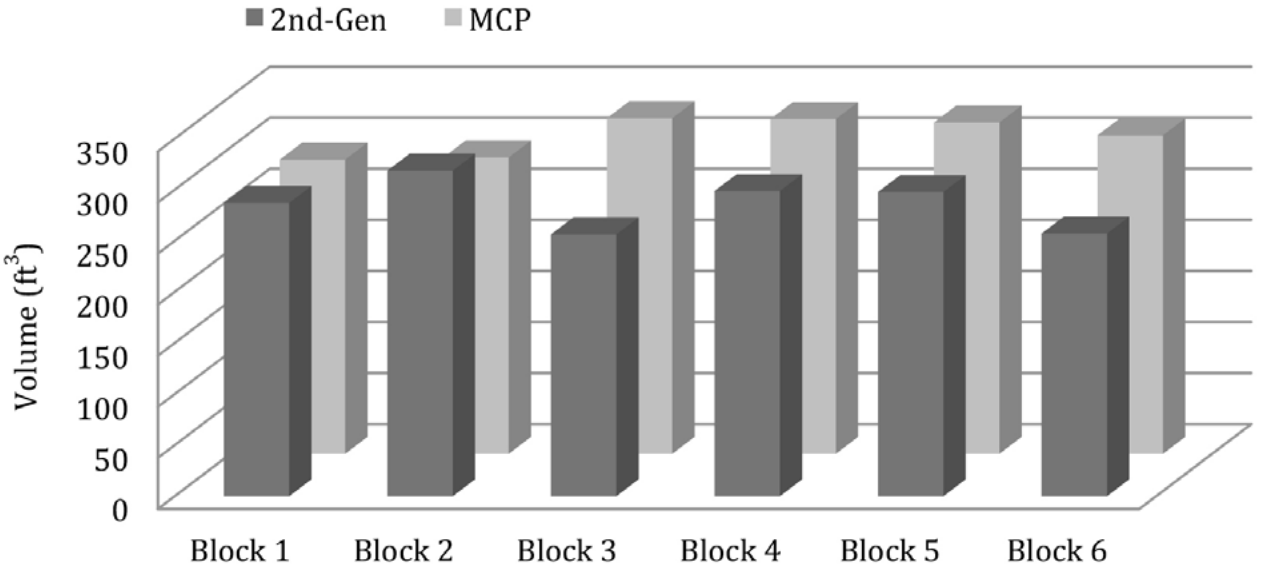

Figure 3. Total volume of the inner 64 trees comparing the second-generation open-pollinated and mass control-pollinated families for each of the six blocks located at the Holly Springs, Mississippi test site.

Table 1. Three top-growing varietals compared to the averages of the second-generation open-pollinated family and the mass control-pollinated family at age 8.

	Age 8		
Genetic Type	**DBH (in)**	**Height (ft)**	**Volume (ft^3)**
Second-generation OP	7.5	32.2	4.78
MCP	7.8	33.8	5.31
Varietal 567	8.0	33.9	5.71
Varietal 586	8.1	33.3	5.66
Varietal 484	7.9	34.1	5.58

quality characteristics combined with good age-8 growth characteristics for diameter, height, and volume (7.5 inches, 33.6 feet, and 4.94 cubic feet, respectively).

Summary

Based on current data, mass control-pollinated seedlings should be preferred over second-generation open-pollinated seedlings. In our test, the mass control-pollinated family showed better diameter, height, and volume growth, as well as greater uniformity over the second-generation open-pollinated family. However, landowners should be cautioned that this better performance depends on good site preparation and herbaceous control. In this study, mass control-pollinated and open-pollinated families showed very similar quality characteristics. Landowners should carefully consider the selection of a mass control-pollinated family that expresses excellent growth as well as quality characteristics so that even greater value can be obtained. Although some varietals have shown excellent growth and quality, more information is needed on stand-level performance before recommendations can be made for landowners to invest in this type of genetic material.

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