

What are the Consequences of Reduced Effort in Tree Improvement?

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When the best families of loblolly pine (*Pinus taeda* L.) are planted and given the necessary resources, growth rates of 300 cubic feet per acre per year (~8 tons per acre per year) can be readily achieved on many sites (Allen et al. 2005). There are few other regions in the world where integrated silvicultural systems, including combinations of intensive site preparation, fertilization, weed control, management of stand density via thinning, management of pests, and use of genetically improved planting stock are having such a large, positive impact on plantation productivity. Today's plantations are growing more than twice as fast as plantations of the previous rotation.

Depending on the site quality, forest management inputs, and the market prices for harvested products, we estimate that the best families are worth between \$50 to \$300 per acre in present value compared to average families that most landowners plant (McKeand et al. 2006). This is the present value of the additional gain that would come to a landowner if he or she simply plants the very best genetic material available from tree breeding programs. Compared to the average families coming from a seed orchard, planting the best families can result in substantial increases in site productivity (as much as a 10-foot increase in site index, base age 25 years), reduce fusiform rust infection levels to almost zero, and increase the percentage of very straight trees that will increase the number of sawlogs harvested per acre to as much as 80%. The additional cost of these seedlings is typically less than \$10 per acre, if there is any additional cost at all.

The primary threat to the continuation of gain and increased profit to landowners is the potential reduction in effort by tree improvement programs in the region. This might sound strange given the long history of breeding and the high rates of return on the investments in tree improvement. As the forest industry has transformed with mergers and consolidations, and forestland ownership has changed from the large vertically integrated forest products companies that owned both land and mills to more institutional investors that often own land for only short periods of time, the number of tree improvement programs and the number of seed orchard and nursery programs have decreased dramatically. Compared to 20 years ago, the number of members within the Cooperative that have internal breeding capabilities has declined from 29 to 12.

With the current, aggressive breeding programs in the Cooperative, we estimate that the value of plantations established increases about 1% each year (i.e. the trees planted this year are 1% more valuable than the trees planted last year). This is due to better genetic material being generated from the breeding and seed orchard programs every year. For instance, seedlings available in the 2008-09 planting season came from the cone crop harvested in 2007 when 2nd-generation seed orchards contributed about 77% of the total seed, and the higher-valued 3rd-generation orchards produced about 12% of the seed crop. Third-generation seeds will make up a higher percentage

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of the crop in the coming years (e.g. 25% of the 2008 cone harvest), and will produce faster-growing, higher-quality, more valuable plantations.

The economic consequence of reducing the effort in tree breeding is staggering. If the genetic gain per year is reduced to any extent, the regional financial impacts are worth millions of dollars. For example, the present value (6% interest rate) of a series of continuously improved plantations was estimated to be \$12,255 per planted acre (e.g. a non-ending series of genetically better plantations of one acre being planted each year). If these same plantations were established with the same genetic quality of seedlings each year (i.e. genetic improvement stopped so that the genetic gain is reduced from 1% per year to 0% per year), the present value would be \$10,262 per acre planted or \$1993 per acre less since all future seedlings would be the same as those planted today.

While it is unlikely that tree improvement efforts will completely stop, there is no question that tree improvement progress could slow considerably. If efforts are reduced only slightly, so that genetic gain is reduced from 1% per year to 0.9% per year, the present value loss to a landowner would be \$232 per acre planted per year. For North Carolina, where 100,000+ acres of loblolly pine are planted each year, the lost opportunity would be over \$23,200,000 of present value. For the entire South where about 1.2 million acres of loblolly pine are planted each year, the loss in value to all landowners from this slight reduction in genetic improvement would be \$288,963,723.

Maintaining efforts in tree improvement has huge economic development implications for the entire South. Unlike other silvicultural inputs into plantations, the benefits from planting genetically improved seedlings are permanent and spread over millions of acres at minimal extra cost. But, if the degree of improvement is compromised or slowed, then there is lost financial benefit. In the Cooperative, we diligently work to maintain the intensive efforts in breeding and production of improved genetic stock so that forest landowners will not suffer lost financial benefits in future plantations, and all citizens of the southern region will benefit from more productive and profitable forests.

REFERENCES

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