

SYNOPSIS OF UTILIZATION RESEARCH ON SRIC RAW MATERIALS

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The take-home message of this paper is this: Raw materials produced using SRIC are suitable for many reconstituted end products. Juvenility, rapid growth, and bark contents do not greatly hinder the usefulness of the raw materials. In the future, increased industrial acceptance of SRIC methods and materials should be a major thrust and is discussed.

The purpose of this review is to see where we have been, where we are now, and where we are going in the future. Initially, the purpose of SRIC (short rotation intensive culture) was to see how productive woody plants could be. How fast could we grow woody plants to satisfy demand for raw materials. Utilization research became important when we realized that SRIC could produce large quantities of biomass, but the biomass was different from that produced by traditional forest management methods. We needed to know if SRIC raw materials were suitable for forest products; which I'll address as the main body of this paper. I'll end the paper with speculation on how to increase industrial acceptance of SRIC methods and materials in the future.

The title of this paper starts with the word synopsis. By definition, a synopsis is a condensed statement. The condensed statement and the take-home message of my paper is this: Raw materials produced using SRIC are suitable for many reconstituted end products. Let's examine the words used in

this statement. First, I used the verb "are," not "maybe," because much research has proven acceptable products can be made from them. Next, the word "suitable" was used, not "best," because products can be made that are within industry standards or guidelines, but there are limitations. The word "many" instead of "all" was used because there have been some failures, but mostly successes. Next, "reconstituted" was used to show these materials are best for products other than those made from solid wood. Lastly, "end products" was used instead of "forest products" to show that uses are broader than traditional uses, such as chemicals and animal feed.

The take-home message is a strong statement. But it is not nearly as novel or controversial as it was in 1976 when some of us in the SRIC program theorized the statement was true. At the 1976 review, I presented a paper on utilization advantages of SRIC materials. Most of the speculation in that paper has proven true, and some warrants repeating. At that time, many people thought that juvenile materials were unsuitable for utilization. However, in the interim, research by us in the SRIC program and by others on different raw materials has shown juvenile materials can be quite acceptable. In fact, some of the strongest and loudest opponents have become advocates of juvenile materials.

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The changing viewpoints on juvenile materials is not surprising when the nature of the material is considered and understood. Juvenile materials have shorter fiber (cells) than older material. Therefore, in paper-making, there is less opportunity for fiber crossings to form interfiber bonds. The strength of interfiber bonds control most paper strengths, not the strength of the fibers themselves. However, the average cell wall thickness of juvenile material is less than older material. These thin cell walls readily collapse into the desired ribbon shape to provide a large surface for bonding, and they are pliable so the fibers can conform to each other to form strong interfiber bonds. Even though there are less bonds due to the short fibers, the bonds present are strong enough that the net result is paper strength properties that are acceptable and within most product standards.

The conformity is also evident in products other than paper. In waferboard, in which particles instead of fibers are used, the conformity allows excellent bonding between particles, and therefore high strengths in the boards produced.

There are additional erroneous conventions other than juvenility about SRIC materials. Rapid growth is sometimes thought to be detrimental. In most conifers, accelerated growth decreases the proportion of summer wood produced, thereby reducing mechanical strength properties. The reduction in mechanical strength affects the suitability for solid wood products. The convention on rapidly grown conifers should not be applied to SRIC in which mainly Populus is grown and which is not intended for solid wood products. Populus is a diffuse porous species and a main effect of accelerated growth is to prolong juvenility.

SRIC materials will be harvested by whole tree methods. They have high bark contents because of the small diameter, branchy stems. Yet, the bark is different and not as detrimental as bark from older stems. The most troublesome cell types in bark increase with increasing age, and the young stems harvested using SRIC have not developed many detrimental bark cells. Further, another problem with conventional whole tree materials is the amount of grit contained in them. The harvesting machines and methods for SRIC materials will greatly decrease grit contents because the materials will not have as much contact with the ground.

To gain increased industrial acceptance of SRIC, corporate decision makers need to be made aware of advantages inherent in both SRIC systems of fiber production and in the SRIC raw materials themselves. SRIC systems and materials must compete with existing, conventional methods and materials. Let's examine the "market leverage" of SRIC systems and materials which might allow penetration into the market held by traditional methods and materials.

For SRIC materials, juvenility, rapid growth, and bark and grit contents were discussed previously. A great advantage of SRIC material is uniformity. SRIC minimizes variability from the three main sources of variation in woody plants; genotype, age, and culture. The uniform raw materials can be processed with conditions closely tailored for them, thereby increasing yields and gaining efficiency. Also, through selection, clones can be grown that are best suited for a particular process and product --- engineering from the growing plant, through the processing plant, to the final product.

For SRIC systems, some of the advantages are self-evident. Transportation costs can be reduced if plantations are located near mills. Harvesting costs can be less. The machinery needed is smaller and less expensive than traditional harvesting machines because the trees in SRIC are smaller and don't vary as much in size.

A major advantage is the insurance value. If a mill has plantations on their own land, they have a readily available fiber supply source and are not as much at the mercy of labor or weather. This guaranteed supply protects their huge capital investment in the mill or plant. Also, because these plantations are grown on good sites, little affected by weather, the millyard needs less inventory and less capital is tied up.

Some of the above advantages of SRIC materials and systems can be quantified and used in economic analyses. Others are harder to quantify, but are still important in decision making processes. We need good information to provide firm numbers for economic analysis. An analysis should address all steps from plantation establishment through to the

final product, to account for tradeoffs and compromises in and between steps. With firm numbers, a final scenario or thought process in a corporate decision maker's mind might go as follows when he is comparing SRIC methods and materials to those of more traditional forest systems:

-My cost of growing the raw materials may be greater with intensive cultivation and fertilization, etc., but because of high growth rates and short rotations I'm getting greater and quicker rates of return, I need less land to grow my raw materials on.

-My harvesting cost will be less, because of the smaller and less expensive machines I need to handle the small trees.

-My transportation cost will be less, because I'll locate my plantations close to my mill.

-My inventory cost will be less, because my plantations are readily available and growing on good land that is operable during most weather conditions. I need less millyard inventory to ensure my plant can continue to operate.

-My processing costs may be greater, because the high bark contents may decrease yields and I'll need additional processing equipment, but the material is uniform and I can be highly efficient in the processing and I can select and grow materials that are suited for my process.

When I add up all these factors, the net result may be a higher balance on the bottom line of the ledger sheet. I'm vertically integrated, and each vertical step serves as insurance to protect my investment in the next step. I'm less dependent on others such as wood suppliers and I'm little affected by weather. All in all, it's not a bad position to be in, and certainly warrants looking into SRIC.

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