



Figure 1. Sawdust stockpiles at many grower operations are aged prior to use in substrate mixes.
Photos: Brian Jackson

PRODUCTION

Growing From the Ground-Up

With advancements in processing technologies and fiber stabilization, wood fiber substrates are gaining traction with growers.

By Dr. Brian E. Jackson and Jackson G. Bobo

The utilization of wood fiber substrates in horticultural production has increased significantly in recent years and is predicted to rise 1,000% globally by the year 2050. More and more growers are beginning to see wood materials as one of the most viable peat alternatives/extenders because they can be sourced locally from many areas around the U.S. at affordable prices.

While there are many commercial wood fibers available in today's market (another aspect that is rapidly growing), some growers are utilizing the forest biomass surrounding them: harvesting and hammer-milling their own wood substrate, or utilizing sawdust obtained as a byproduct of the lumber industry (Figure 1).

Hammer-milling is a relatively inexpensive machine and processing technique that can be used to make various types and sizes of wood (and other biomass like *Miscanthus*) substrate components. Many commercial wood substrates on the market today use multi-million dollar machines such as extruders or disc refiners, making a different high-quality fiber product, but at a higher cost point.

Both the extrusion and refining processing methods generate or expose wood to high temperatures, which is believed to render the wood chemically (phytotoxically) "sterile," a benefit that the hammer-mill system does not possess due to little to no heat generation in the process. However, after many meetings and discussions with growers using these materials, they are increasingly excited about the prospect of producing their own hammer-milled wood substrate that can stretch their peat supplies, producing an effective and economical substrate.

Phytotoxicity Challenge in Substrates

One major issue of using freshly milled/processed wood as a substrate component is the high risk of it imparting phytotox-icities on the plants grown in them. There have been several studies directed at this problem, and the main consensus is that wood, when freshly harvested and processed (without heat), has residual chemicals such as polyphenols, resin acids, fatty acids, and tannins (to name only a few) that trees use as defensive mechanisms while alive. Once trees are felled



Figure 2. This collage shows the process of harvesting, chipping, milling, and aging pine trees for use as substrate components.

and processed, these chemicals must be removed to ensure a non-toxic substrate. Growers that are utilizing these methods have expressed to us personally the plant growth retardation observed when using a fresh wood substrate.

Case in point: Young's Plant Farm in Auburn, AL, has been an industry leader in its efforts to make and utilize its own hammer-milled pine tree substrate, something it has successfully done for more than 15 years (Figure 2). This approach to removing the harmful wood extractives involves aging the processed wood in super sacks (outdoors) for more than 60 days prior to use in growing media formulations.

Current research efforts are underway to 1) identify ways to screen processed wood materials for the presence of phytotoxic chemicals, 2) explore preconditioning strategies to remove harmful chemicals from fresh wood, 3) understand the duration of "aging" needed to naturally remove wood chemistries at different times/seasons of the year, and 4) quantify and compare how, and to what extent, different wood processing techniques (machinery) remove phytotoxic chemicals from fresh wood chips.

If You Smell It, the Roots Taste It

Regarding the chemicals in freshly processed wood, bark, or other organic biomass materials, it can be said that "if you can smell it, the roots can likely taste it". Many of the phytotoxic

extractives in forest products are both volatile and soluble, lending us the ability to use smell as one quick screening approach when questioning if a wood material is fresh or has been aged or treated in some way to remove those volatile compounds.

Given the solubility of many wood chemicals, one research approach used to assess the presence and quantity of potentially harmful (phytotoxic) extractives is to create leachate by soaking wood in water. The wood leachate from this process is then used in a variety of plant growth bioassays to screen for plant growth inhibition (Figure 3). Bioassays include seed germination tests using sensitive plant species (lettuce, radish, and tomato) which can be conducted in five to seven days to assess germination rates as well as root (radical) growth.

In this process, the wood leachate has a fertilizer solution added to it and it is then used to irrigate tomatoes grown in sand for a period of seven to 14 days (length of time can vary) compared to clear water plus fertilizer control. Plant growth from these bioassays has reliably shown when phytotoxic substances are present, and when they are not. Through these test results, we are better able to gauge the effectiveness of wood aging, heating/drying of freshly processed wood, effectiveness of activated carbon and other chemical binders on the removal of phytotoxic wood chemicals.

Once free from phytotoxic chemicals, wood or any other substrate material can then be used as a component with peat or other substrates to create growing mixes. At that point, nutrients, water, and pH are the key areas of plant production

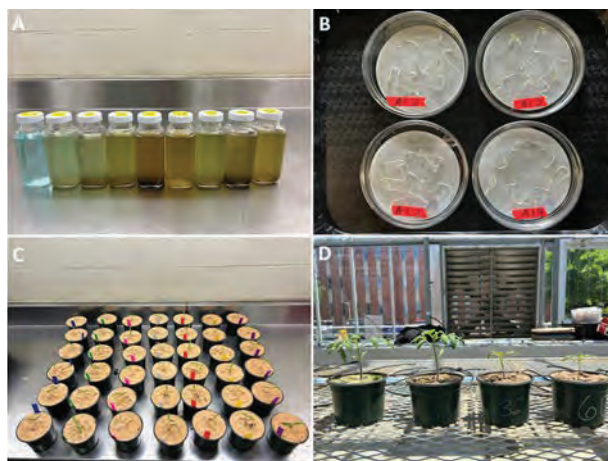


Figure 3. Bioassays are used in determining phytotoxicity potential/presence in fresh wood substrate materials.

management that must be tailored to the specific crops being grown. The higher the wood incorporation rate (less peat), the more changes and challenges there will likely be.

The advancements in wood processing technologies as well as a better understanding of wood fiber stabilization have opened the possibility for hardwood materials to be successfully utilized. This holds enormous potential due to the cost, abundance, and under-utilization of hardwood species across the U.S. and the world.

GG

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