

The future of substrates

Researchers seek alternatives to meet the need for growing media



Researchers at the North Willamette Research and Extension Center, an arm of Oregon State University, have tested various formulations of bamboo-amended substrates by growing these hibiscus plants in containers.

By Wade J. Pruett

Growers use a wide variety of organically based growing media substrates and blends to grow a vast array of container crops. Many commonly-used substrates are experiencing a variety of pressures that are leading to scarcity, high prices, environmental scrutiny and other difficulties.

In response, growing media producers, university researchers and even the growers themselves are exploring alternatives to the traditional substrates.

Peat moss has been a staple material for container growers for decades.

Its unique chemical and physical properties make it ideal for growing plants. However, the use of peat moss has come under greater scrutiny in recent years as concerns about the cost of the material and the environmental sustainability of peat harvest and transport weighs heavily on peoples' minds.

A wide range of organically based growing media substrates are currently available in the Pacific Northwest. These include peat moss, coconut coir, tree bark, sawdust, manure composts, non-composted manure materials (digested dairy fiber, bedding recovery solids), yard debris compost, food waste

compost, recycled paper fiber, worm compost, and rice hulls. Many of these products are produced locally, providing growers with options that can be considered sustainable and supportive of local communities.

Pressures on the supply of organically based potting mix substrates fluctuate from year to year and vary by region. The poor housing economy and resultant reduction in lumber production has caused a severe bark shortage this year in the Northwest, as has been the case in the past couple of years.

However, the poor economy has reduced nursery production, easing the demand on bark. Bark supplies appear to be fairly stable this year, but the future remains uncertain.

The use of wood products as fuel also threatens supplies of bark for potting mixes. Bark and sawdust have long been used as fuel for power at mills and other power plants, but new biofuel initiatives are increasing the demand for organic matter. A relatively new source of concern for the users of organic matter substrates includes the use of these materials to produce biofuels such as ethylene.

The bark and mulch industry has taken great issue with the Farm Service Agency's Biomass Crop Assistance Program (BCAP) and its effects on the forestry residuals market. Industry outcry about this program appears to be

producing results, but the final rules have not yet been revealed.

New materials for potting mixes

There are a variety of new materials that are either currently available or have recently undergone research and growth trials throughout the United States. These include processed wood from whole forest trees, ground forestry slash, poplar plantation slash, unsold Christmas trees, bamboo, chipped willow trees, grass stubble, Fluff (recycled household garbage), biosolids compost (composted human waste), wheat straw, corn stover and various others. There are also biomass crops, such as *Miscanthus giganteus* and switchgrass.

In Europe, there are a number of producers of mechanically separated wood fiber (Toresa, Fibratur, Torbella, Pietal, Cultifibre etc.) that are being

used as peat alternatives. So far, production of these separated wood fiber materials in the United States appears to be too costly to implement, especially given the relative abundance of bark in many important horticultural production areas.

Some of these alternative materials have been shown, through research, not to be suitable substrates for growing media, but many are proving to have great potential. Each material has inherent limitations in terms of chemistry, physical properties, production capacity and seasonal/regional availability. A brief explanation of the results of recent research on some of these alternative materials follows.

East and Southeast States (plus Kansas) — The use of processed wood from whole trees and forestry slash piles in growing media substrates shows great promise.

A handful of researchers such as Robert Wright (Virginia Tech), Brian Jackson (North Carolina State University), Cheryl Boyer (Kansas State University), Glenn Fain (Auburn University) and others have produced a solid body of work showing that 100 percent ground trees and slash can be used as growing media for the production of high-quality nursery and greenhouse crops. Their research shows that the ground trees and slash can be used with equal effectiveness as compared to traditional (peat- or bark-based) mixes.

A wide variety of particle sizes can be produced via shredding or hammer milling to provide the desired physical properties for a wide range of growing conditions. In some cases, additional nitrogen supplementation is required to counter nitrogen immobilization by microbes decomposing the substrates, especially for faster growing greenhouse crops.

In many cases, however, the current rate of fertilization may be sufficient to supply the needs of both the microbes and the crops being grown.

Oregon — Jim Owen, Heather Stoven and colleagues at Oregon State

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Get Growing

University's North Willamette Research and Extension Center are conducting research using various sources of chipped and milled wood such as culled nursery trees, bamboo, unsold Christmas trees, poplar and others. Fescue and rye grass stubble are also being researched as potential growing media substrates. These materials are residues from the grass seed industry in the Willamette Valley of Oregon.

Much of this research is ongoing, but initial results show that some of the wood sources could be suitable substrates for growing media in the future. The primary problem with using these materials as substrates is the lack of infrastructure to harvest and process the wood into usable product for potting mixes.

Additionally, it is becoming evident that each material has its own peculiarities regarding plant growth response. In recent trials, geraniums grown in a bamboo substrate flowered well, but had less foliar growth than control plants. Meanwhile, a rye grass substrate provided an opposite effect.

So far, the grass stubble materials are questionable for a variety of reasons. Rapid decomposition and copious quantities of viable grass seed are the primary problems, along with the high likelihood of herbicide contamination.

The research on these materials is ongoing, so watch for results in the coming months or years.

Ohio — Crops such as giant *Miscanthus*, switchgrass, chipped willow, bamboo and wheat straw are also being considered as potential potting media substrates. These materials are under investigation by James Altland and colleagues at the USDA-ARS Application Technology Research Unit in Wooster, Ohio. Their intent is to study potential alternative substrates that are, or could be, available or grown by plant producers in Ohio but these crops could also be produced in a wide range of locations across the world.

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These azalea plants were grown in varying rates of Douglas fir slash and culled Christmas tree amended bark substrate at Oregon State University North Willamette Research and Extension Center in Aurora, Ore.

The biomass materials have good water holding and aeration properties, are easily grown in high density, light in weight (a potential problem as well as a benefit), and producible in a wide range of geographic locations. Challenges presented by the materials include nitrogen immobilization, shrinkage, elevated pH, weeds from the substrate seeds, herbicide residue and difficulty of use in very small container cells. Most of these problems have fairly easily been overcome in the research trials.

Washington — Biosolids compost is currently used to produce Tagro potting mix in the Tacoma, Wash. area. Research conducted by horticultural scientists at Washington State University Puyallup (Rita Hummel, Craig Cogger, Michele Krucker, Robert Riley, Andy Bary and Susan Smith) shows that Class A biosolids, when used as a portion of a potting mix, can be a very useful substrate. The material is too dense/fine

and high in nitrogen to be used as a majority substrate in a potting mix, but when used at approximately 20 percent by volume with sawdust and bark, it makes for a very effective substrate.

Mind the details

In the quest for new potting media substrates, we must consider the physical and chemical properties of each substrate and how these properties will interact with each other and the container system as a whole.

Additionally, each substrate must be evaluated for longevity and the presence of undesirables such as weed seeds, pathogens and contamination by foreign debris such as garbage, glass, rocks and other substances.

Availability of the material throughout the year and within reasonable distance to key plant production regions is vital. Finally, the production or processing of any material intended for use as a growing media will require a certain

amount of infrastructure to bring the material to market.

The future of growing media is a little uncertain. What we do know is that there are some significant and interesting changes coming in the years ahead. Various new substrate materials will be undergoing research, growth trials and introduction into the commercial horticulture industry in the near future.

Thanks to the diligent efforts of researchers, growing media producers and growers alike, a wider range of substrates and potting mixes will become available in the coming years. Growers should support the research efforts of extension agents, growing media producers and others as the world of growing media changes in the coming years. ☺

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