

Innovations and Challenges in the World of Sustainable Soilless Substrates

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At no point in the past 50 years have more advances and industry-wide efforts been initiated to improve the performance and product offerings of soilless substrates for horticultural crop production. North American scientists and industry professionals are partnering on key initiatives regarding product sustainability, environmental stewardship, and securing future substrate resources/supply needs in very big ways. Innovations and challenges await our industry on the horizon, but rest assured that big plans and strategic actions are already underway to support current and future growth of the aggressively expanding container plant production market.

One of the key innovations in substrate science has been the utilization of Micro-CT image analysis as a tool to better understand (by non-invasively seeing inside) rootzone systems, water movement, and plant root growth in them (**Fig. 1**). Under the appropriate conditions, these images can reveal remarkable detail in a plant's root architecture. Similar to substrate characterization, 3D rendered root systems can be characterized by root volume, length, surface area, and diameter. The spatial distribution of the root system can also be characterized with the same analyses used to generate data for water distributions within a container. This non-invasive imaging tool has horticultural implications in three main areas: the substrate, the pores, and the plants. With such wide-ranging implications for this type of high-

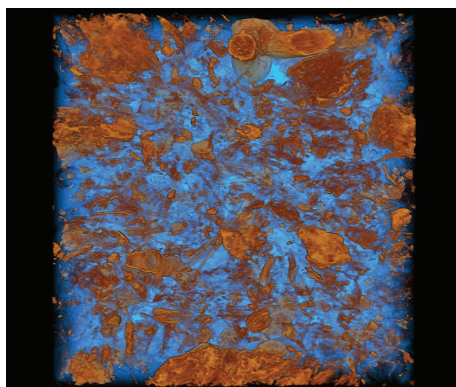


Figure 1: Tomographic reconstruction of a Sphagnum peat substrate highlighting the solid particles (brown) and open pores filled with air and water (blue).

tech substrate research, it is our goal to identify as many practical applications from this innovative, foundational research as possible.



Figure 2: Sampling of some commercial engineered wood fiber substrate materials currently on the market.

A second substantial innovation well underway in substrate science globally is the development, characterization, and utilization/adoption of engineered wood substrates (**Fig. 2**). A significant amount of scientific research has been conducted on the use of these materials in recent years. Confidence has risen (notably since 2015) based on a variety of factors including the consistency of results across differing studies, similarity of data/results on east coast and west coast, repeated results from trials spread out over a decade, notable positive plant growth response across a wide range of species and production system types, etc. With the use of wood substrates and substrate components on the rise, one of the many questions often asked by growers and the general public is about the sustainability of using wood and the long-term impacts and supply of one of our most valuable (economic and environmental) natural resources. One way to address that legitimate concern is to take a look at forest lands and resources in the U.S. The most productive forest region in the world is right here in the Southern forests of our great country, known as the "Wood Basket of the World." These wood resources are extremely versatile, malleable, and sustainable and in abundant supply for all current and foreseeable wood-based needs.

In addition to discussions about wood fiber and other "alternative" substrate materials for our current and future cropping systems, I would also like to applaud the peat industry for all that they are doing in support of continued substrate science and product development as well as their collective extreme awareness



Figure 3: Peatland reclamation efforts (after harvest) by peat producers are proving very successful and are improving the sustainability of peat moss utilization.

and involvement in sustainability and environmental stewardship. There continues to be debate and, in many instances, false narratives about peat and its sustainability in the future. A few things my travels and engagement with the peat industry both in North America and Europe have taught me are that they 1) are committed to sustainability efforts; 2) are proactive with peatland management and restoration (**Fig. 3**); 3) are adamant about maintaining proper harvesting techniques; 4) invest vast resources and efforts into product consistency and quality assurance; and 5) are willing to evolve as horticultural production needs and challenges arise in the future.

No other industry within horticulture is more invested or focused in the future of production horticulture (ornamentals and consumables) than our substrate colleagues. Substrate scientists at NC State University are actively involved in national and international organizations, societies, and coalitions that are coordinating research and outreach efforts to meet the high demand and expectations of growers around the globe! Grow on!

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