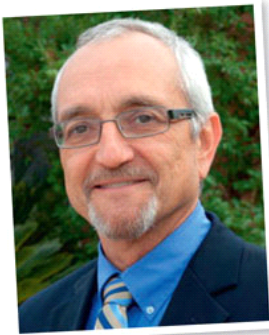


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Media: Out of Sight, But Not to Be Ignored

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Understanding and utilizing substrates for growing plants is a science all to itself. The root zone substrate and associated root zone environment within every growing system provides the physical, chemical and microbiological properties that will affect plant growth.

Full disclosure: I don't believe there's only one best media mixture within a plant growing system. I trust that most can be good, if properly managed, and leave it to the soils researchers to explain the whys and hows. However, I do believe that substrate is a highly impactful factor in addition to 1) plant species; and 2) the nutrient delivery system (NDS) in crop production. Each of the three should be selected to match the grower's experience, the environmental conditions to

be provided, the product marketing requirements and the degree of labor-saving automation of the greenhouse crop production system. That is, although substrate is very important for development of a healthy plant root system, it must function with other greenhouse systems and practices for efficient operations.

The root zone substrate is the interface for the plant roots with pore spaces containing the atmosphere and moisture of the nutrient solution. The NDS provides the flow of nutrient water during irrigation, temporarily filling the pore spaces that are distributed throughout the root zone. The flow of solution provides water, nutrients and dissolved oxygen, and with drainage of excess water, it also removes salts and root exudates.

When selecting a substrate for potted plants, consider its attributes such as density and weight, whether recyclable, and tolerance of the mistreatment of the product that may occur after sale. A properly formulated root zone media should maintain its initial properties, without significant change during its lifespan. These include physical properties, such as water-holding capacity, drainage, ease of filling substrate to a uniform density and wettability, as well as chemical properties of pH and electrical conductivity.

An automated nutrient delivery system may range from overhead watering with traditional top drip irrigation to unique "bottom" irrigation with ebb and flood (E&F) to the exotic direct spraying of the exposed roots in aeroponics. Each can meet the requirements of a production situation of a plant species and root zone substrate. However, each must meet the dynamic plant growth factors and the water demand from the young seedling stage through harvest, and for the high plant transpiration (water use) within the environmental conditions of the entire production period. Automation of irrigation may be as straightforward as timeclock

control with experience of knowing the required daily application frequency or more precisely with electronic sensor measurement of substrate moisture content and as elaborate as a solar radiation-monitoring controller to trigger irrigation cycles.

As an example, a specific mixture of soilless components was developed for E&F systems, which were designed for greenhouse internal transport systems such as transportable benches in part because of their labor-saving operations. Researcher Dr. Chris Blok at Wageningen University & Research (WUR), the premier research center for CEA in the Netherlands, determined that an E&F NDS required special irrigation practices and a carefully blended substrate in the pots.

An E&F irrigation system provides irrigation water to saturate 1 to 2 cm of the bottom of the plant root zone during flooding. A minimum air-filled pore space of 15% to 20% by volume is needed for root respiration. Highly water absorbing materials like peat and coir pith can easily be over-irrigated. Therefore, materials with a higher air content at saturation, such as perlite and wood fiber, should be added, typically between 15% and 40% by volume in an E&F substrate. The substrate should re-saturate quickly and transport the irrigation water to the top of the container within the duration of the irrigation cycle. Therefore, a typical requirement for growing media used in E&F is a minimum air content of 15% at saturation and a minimum water uptake rate of 50% by volume within 15 minutes. For example, peat/perlite, peat/coir or wood fiber make good combinations.

Finally, consider the irrigation cycle, which should provide flooding of short duration (five to 10 minutes), allowing sufficient time to wet the substrate, followed by immediate drainage, rather than less frequent cycles of longer duration of flooding. This practice enhances root zone oxygen, essential for healthy roots, as air is drawn into the substrate as the water recedes from the bottom of the pot.

Hopefully, even with focus on the substrate, we appreciate that it's all about the plant!

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