GROWERTALKS

Features

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What’s Underneath the Surface?

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Before we talk about the research, I have to share how this story came about. Back in late winter at Indoor Ag-Con, there was a panel discussion about soilless media and an attendee asked about the potential for a completely sterile media to grow in along with a sterile environment.

It was an interesting question that got me to wondering, is that even possible, and if it is, would there be a benefit to that? I reached out to Dr. James Altland, the research leader at USDA-ARS Application Technology Research Unit in Wooster, Ohio. His specialization is in substrate technology, and he’s been working with researchers to take a closer look at what’s happening related to substrates and the root system in hydroponic production.

Pictured: Fiama Guevara, a Ph.D. candidate at The Ohio State University, took samples at university research greenhouses and commercial facilities to better understand microbes in the root zone.

I asked him about the question from the show, and he said examples like rockwool and perlite are inorganic and the creation of both involve high temperatures, so they’re essentially sterile at the time they’re made. But this is where it gets dicey.

“However, the day they are put in a greenhouse environment with a nutrient solution, plant roots, whatever, they are quickly colonized by bacteria,” he said. “There could be fungi or some other types of organisms, but it's mostly bacteria.”

That means the sterile growing environment is probably unrealistic, and there are many beneficial microbes, both bacteria and fungi, that can help plants in their growth. But James went further and said researchers at The Ohio State University are diving in deeper to the microorganisms that exist surrounding the root zone as it relates to the soilless media. It’s really just the beginning in gaining a deeper understanding of what’s happening around that root zone in a hydroponic system. I asked him why this type of study is important to advancing hydroponic production.

“I think understanding the biological component of a system is incredibly important. As an analogy, you look at what science is telling us now about our gut microbiome,” he said as an example. “I think there is very good science in understanding how that microbiome affects your mood, your personality and a lot of your health.”

Could the same happen with plants? Is that microbiome underneath the plant impacting its health? James referred me to Dr. Soledad Benitez Ponce, Associate Professor of Phytobacteriology at The Ohio State University. Her main focus is plant microbiome research, which she's been studying since her Ph.D. days.

"Generally, what drives my research is that I am interested in understanding where microbes are found in agricultural systems, what are they doing and how we can potentially manage them to improve crop growth," she told me. "I talk about the collection of microbes, not just a specific organism or a specific pathogen, so I try to look at everything that's in there."

Initially, she was looking at in-ground soil, which has a multitude of microbial activity, but now she's also working on soilless hydroponic media.

"We decided to do this work in soilless systems for multiple reasons. One, as you know, the control environment agriculture industry is growing. So there's definitely a niche there that needs to be filled. And the other one is because we really do not understand which microbes are there—in soilless media or hydroponics—where they are and what they're doing," she said, noting there are fewer microbes in the soilless media compared to soil. "Having an environment with less microbial complexity could help us be more successful in managing those that are important for plant growth."

In her research they took samples from real-world commercial hydroponic lettuce production systems, both nutrient film technique (NFT) and deep water culture (DWC). First, they identified some of the microbes they wanted to search for that have been beneficial in other systems for mobilization of nutrients and then went on a microscopic treasure hunt.

"So we found that, in general, we find more of the microbes on the roots and the growing media, the substrate that's holding the root. We find more there than when we look at the nutrient solution itself or the leaves," she said. "This makes sense because the plants provide the carbon for the microbes and this carbon can go to growing media around the roots. But in both the growing media and the roots there's the influence of the nutrient solution.

"The growing media is the area where you have interaction of all the different parts of the system."

They tested lots of different combinations of growing practices, too, related to temperature, humidity, nutrient solution management and others to see if any one factor more heavily influenced the presence of microbes in the system. Based on their data, she said it was hard to say if one factor had more influence over another, but one important point came out of the exercise: the importance of sanitation practices.

"I think that it is probably one of the biggest factors in terms of how many microbes are present in the hydroponic systems," she added.

Soledad noted there are two schools of thought when it comes to sanitation—either run a system really, really clean consistently or clean it less often and build microbes that could potentially help the system. They haven't been able to determine whether one is better than another, she said.

The other aspect of this is the type of microbes being studied. In very basic terms, are they good or bad for the system? They're beginning to make some headway here, but more research is needed. They can begin pinpointing bacteria and fungi in the system, but it's still hard to tell whether or not they'll be beneficial or a pathogen.

“To give you an example, we have bacteria within the group of Pseudomonas. Some of them help plants grow and some others are plant pathogens,” she said. “And the tools that we are currently using do not allow us to differentiate between those two. I can just tell you, this is a Pseudomonas, but we cannot really say this is the pathogenic one or it is not. We need to do more experiments.” **GT**

> **For More Details**
> This is a very cursory look at the research being conducted by the folks at The Ohio State University. GO HERE to read the full research paper by Soledad Benitez Ponce, Fiama Guevara, Timothy Frey and Antonino Malacrinò.