Agriculture and the Microbiome

August 25, 2020 Webinar Questions and Answers

Panelists: Megan Andrews, Ignazio Carbone, Elizabeth Stulberg, Gregory Maloney, Carolyn Young

Per capita per cropland acres doesn't necessarily mean the absolute amount of ag land is decreasing, right? Based on what we see happening in places like Brazil, it could be absolute crop land is increasing? We are just seeing rising population driving the need to use those acres more productively.

> Carolyn: If we just address the situation in the USA, the sprawling population is forcing some prime cropland and grazing lands to less productive areas, in part precipitated by an increase in population and people who wanted a lifestyle property. So more needs to be done in less productive areas.

Do you have the algorithm to capture the UAV reading?

> Megan: Rob Austin at NC State University would be the person to contact for UAV questions.

Shouldn't we be using system wide approaches that attempt to identify highest and best uses and systems for each acre vs. trying to drive productivity through outdated production strategies that are causing environmental havoc?

> Carolyn: Yes, we can help with better products, but by understanding the complexity of the microbiome we can also learn to better manage these. As an example—using regenerative agriculture—what will that do for the microbes?

How does microbiome research help in the food security issues during the present Corona pandemic?

> Elizabeth: Microbiome research has the potential to help foods keep post-harvest (the primary driver of food waste in the developing world, where food security issues could be most dire) and to prevent pest or pathogen damage, for example through amping up the crop's immune system. This could prevent a catastrophe on top of the pandemic.

Would it be wise to establish some sampling, analytical variability, and statistical assessment of the data gathering effort? If we could establish some confidence levels for each input, we may be better able to focus resources where high variability limits our ability to fully utilize data.

> Elizabeth: Standardized sampling and FAIR data repository!

I heard a strong bias toward microbial "products" as the targeted deliverables of this research. I'm sure they have a role to play, but I'm concerned that microbial "magic bullets" have limitations like chemicals and other tactics we use now. I am frankly more intrigued to find out how cultural practices may shift natural microbial communities toward beneficials. The single strain or few strain supplementation approach seems naive considering the complexity that has been described.

> Carolyn: There is a growing interest in soil health and how we can use regenerative agriculture principals to help improve the land. Many of the approaches used to identify new microbes can also be used to improve our understanding of the core functional microbiome and what happens under different cultural management practices.

Are you also considering the possibility where the beneficial microbe is transformed to a plant pathogen?

> Elizabeth: I think this goes with my earlier answer that we're not really talking about genetically modifying these microbes, and "transformed" usually means genetically modify. But, is it possible that a beneficial microbe in one environment could become a plant pest in another? I suppose it is possible. If so, then USDA's APHIS would regulate it under its plant pest authority.

Is it true that biostimulants are less regulated and easy to get approved?

> Elizabeth: The issue here is that biostimulants are currently regulated based on what they do, not what they are. So if they act as pesticides, then they are regulated by EPA, but what if they are affecting plant growth in another way, for example a new mode of action. It is unclear how EPA will regulate these biostimulants, and in that regulatory gray-zone, it may not be "easy" to get approved. Instead, it may be complicated.

Is your use of microbes-based precision agriculture based on microbes as taxonomic units or based on the metagenomes? Is 16S sequencing an accurate measure of the functional potential of the existing community when things like horizontal gene transfer and micro-diversity exist?

> Megan: The goal would be to use functional information about the microbes rather than just 16S information. That is part of what makes this endeavor so data-intensive and requires advances in techniques like machine learning in conjunction with advances in measuring and understanding what microbes are present and what they are doing. 16S sequencing is only a small part of the larger complex puzzle.

I've had trouble with EPA authorization for a microbial product we developed with several strains that help with nutrient availability, but they say that some of these strains can also have a control activity. How can I approach this? All microorganisms can have microbial activity only for space competition.

Elizabeth: It's true that all microorganisms could technically compete for space, but it's possible that by "control activity," EPA is referring to a chemical that your strains are known to produce that have effects on other microbes. If that's the case, EPA may classify these strains as pesticidal. I would aim to find out what specifically is the control agent the EPA is referring to here. Usually you can get on the phone with someone to discuss the issue.

Database idea is great—wonder if it might become part of the USDA FoodData Central as you move towards what this means for human food consumption, wellness, etc.?

Elizabeth: Right now, the Ag Data Commons is the most likely place for ag data to be housed. But it's true that there are multiple potential databases across government housing different kinds of data which, in a perfect world, would all be synced together. The Department of Energy, for example, houses the National Microbiome Data Collaborative (https://microbiomedata.org), which is a relatively new, Congressionally-funded database specifically intended for microbiome data. Whether they will be able to incorporate agricultural data as they create this database remains to be seen, though they are actively reaching out to ag research communities.

Not all questions from the webinar were answered in this document.