



Season 2 Episode 6 – Aquaponics & Food Safety

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Announcer: Welcome to the Farming Basics podcast with Olivia Fuller. We'll have sustainable farming tips from growers across the state and Extension specialists at Auburn University.

Olivia: Welcome back, everybody. This is your host, Olivia Fuller, and your co-host Jacob Kelley. Today we have Camila Rodrigues and Caroline Blanchard, who is a research associate under Camila Rodrigues, who's the food safety specialist on our team. So we're gonna talk about some of her upcoming projects. They're surrounding aquaponics and hydroponics. So we're really excited about this topic because it's under-researched here in the South as far as I've been able to tell. It seems to be popping up everywhere else across the world. Indoor agriculture is quite the hot topic most everywhere else you look, but here it's still kind of new. So we're excited to learn about your research, Camila. Thanks for coming on.

Camila: Thank you for having me again here. I'm excited about all my projects related to aquaponic and hydroponics and control environment, agriculture in general. I currently have research projects and Extension projects that are coming up. We all know that food safety is a big issue and it's still a rising problem in the agriculture. And for fresh produce safeties, it's still being on the lead cause of foodborne illnesses in the United States. And if you think about control environment, and sometimes people think it's the solution to foodborne illnesses. It could be, you know, it could be safer. But it's still, there are other risks, there are other problems that it's not, people think about this as being the safest option and then growing safe produce and they don't pay attention enough on the safety risks that are actually there.

You know, they're still being handled by humans and it's not a sterile environment, so it's impossible to grow, you know, fruits and vegetables is sterile. So, and we have to think about food safety and specifically for aquaponics. If you think about the aquaponic system, which is a living sustainable system, we have fish that is

growing on one side, we have plants that is growing on other side, but we also have all the beneficial bacteria, all the biome and the system. So you cannot do much to kill pathogens in the water. So if you have contamination with salmonella in the water or e. coli or even listeria, that could be a problem because those systems are, you know, plants are growing underwater and everything. There's not much you can do to eliminate once the microorganism are there. So one of my research topic is that I'm looking for biocontrols or bio agents that could be targeting some of these specific pathogens as say, salmonella e. coli or, you know, or even listeria.

Olivia: That way you can kill those specifically, but not all of the others.

Camila: Correct.

Olivia: Because yeah, it's impossible to grow in a true sterile environment. And one, you really, you wouldn't want to at the same time. Like it's, you need some of that growing in the system.

Camila: Exactly. So when we talk about water that is used in irrigation for conventional farms there is, you know, options for chemical treatments in the water. You can chlorinate the water or can use UV to literally kill all the microorganisms in the water because you are not putting the water there to, you have the soil that has all the beneficial microbiome, and then you have the beneficial bacteria and that it's doing their job. It's not the water itself. But in the aquaponic, for example, we have the water, you know, all the beneficial bacteria that is supposed to be in the soil, we have them in the water coming from the fish. And then that is a sustainable, you know environment that...

Olivia: It's sustainable to continue.

Camila: Yeah. So we have a sustainable system that it's continuing, you know, all the bacteria that are in there, they're beneficial for the plants, but they're also beneficial for the fish. So we cannot kill those and we don't, and then what we work with is biocontrols there are target microorganisms in general that can target those specific bacteria. In the case research that I'm conducting right now, I'm looking at bacterial phage as an agent to control salmonella in the water. So for those that they don't know, bacterial phage, also called phage, are the most abundant living organism in the world. And probably there is, they're responsible for, you know, life and earth because these are the organism that maintain in bacterial population proliferation, in equilibrium. You know, there are phages everywhere controlling bacterial growth and everything. So phages only targets, there are viruses that target a specific bacteria. So we can look at phage that is specifically target salmonella, e. coli, listeria, and then so on.

Olivia: Okay. So that's very helpful because I mean, economics are at play here when people are working with these large systems and growing produce in this way. They have a lot at stake, 'cause if one little thing goes wrong, which sometimes isn't necessarily the case in the fields, but it can be, but certainly here, one little thing infecting that system is going to spread rapidly, I imagine.

Camila: Yes. And water is the, you know, the biggest concern for food safety concern, because water can, you know, carry pathogens everywhere and especially you're looking at a hydroponic and aquaponic, it is grown in water, so it's... If microorganism, you know, pathogens fall into the water, you know, fish are now hosts for e. coli, salmonella, human pathogens, but cross-contamination or if those bacteria fall into the system for some reason, they will survive there. They will persist and they can, you know, be carried throughout the whole system and then, you know, contaminate the plants.

Olivia: And this is with either/or aquaponics or hydroponics, because some people think of aquaponics being maybe the one that's harder to control diseases in, but really it sounds like both you're at risk for--

Camila: Yes. So because water is just everywhere. You know, you're using water as a vehicle, you know, as a growth media. So once the microorganism pathogens falls in the water and that is a big problem. And then also in equipment, you know, if you think about the growing rafts and the, you know, the growing trays and everything, microorganisms can stick pretty bad in there and they're pretty hard to clean.

Olivia: Yeah. Oh yeah. I've seen the process of trying to take all of that down and clean it properly and that looks, I mean, that's a full-time job in and of itself, just maintaining those little pieces and putting them back together.

Camila: So that's why the cleaning and sanitizing is a pretty big important in those operations.

Olivia: So just to make sure that our listeners are super clear on everything, 'cause I don't know that everyone, like I said, in the South, it's kind of under researched here and we don't have many growers implementing these practices. So would you tell me the difference between aquaponics and hydroponics and kind of explain both systems just so that everybody has an understanding if they want to get into that.

Camila: I'll let Caroline talk a little bit about that.

Caroline: Hydroponics and aquaponics are kind of just two separate systems that both use water to carry nutrients to the plants. So in hydroponics you have fertilizer that's dissolved in water and that's gonna carry your nutrients to the plants so they can grow and produce fruit. In aquaponics you're using fish waste as a nutrient source instead of fertilizers. So that fish waste is gonna provide all of the plant essential elements to your crop so that it can grow.

Jacob: So fish poop is the difference?

Caroline: That's correct.

Jacob: Okay. It's hard to raise fish, right? I mean, I worked at the fish station for a little while and fish just want to die all the time, especially tilapia and things like that when we keep 'em in ponds and things like that. And using water sources that are from creeks and lakes of where other fish might be, there's ick and all these diseases I've never even heard of. I felt like every time I walked in the lab they were putting a Harry Potter spell on me. So it's not just growing the plants hydroponically, but also you gotta be a fish raiser, a fisher raiser. Someone who can raise fish.

Caroline: Definitely. Yeah. Water quality is important for both fish and plants and if the water quality in the fish tank isn't great, your fish are gonna suffer for it.

Jacob: Camila, can you tell us a little bit about, tell us and the world, about the projects you're working on for hydroponics?

Camila: Absolutely. So other than my research project, I also have an Extension project that is focused on developing new curricula, food safety curricula for aquaponic and hydroponics, and educational materials, because currently all the available resources that we have are for field growers, you know. And even though the food safety practices might be relatively the same, we have to look at water quality, you have to look at cleaning and sanitizing, worker training. There are different risks and there are different practices that we need to be, you know, focused for aquaponic hydroponic. I can give you a pretty good example. You know, when I talked to a grower once, he mentioned that the most difficult portion on implementing food safety practices on his aquaponic operation, it was that making sure that workers understood that they could not touch the water with one hand and they had to, you know, they had to pick up the plant with one hand and then the other they had to cut it, but make sure that the hand did not touch the water. So they said it was tricky because it makes work harder. It probably delays, you know, harvesting, all of the practices, but that is something they had to implement over. And that is something, you know, if you think about fieldwork and everything, you know, touching the soil, it's not that a big deal if you're--

Jacob: You're gonna play in the dirt when it's available.

Camila: But in the water, you know, if you think about, well, plants are being grown in the water, they're touching all the time, but if you think about it, you know, they're growing above water and because it is a closed system when you say about recirculating water and everything, but it's still, it is an open source. So we need to think about it, you know, all these practices that are different and then we are not growing in soil, so we don't talk about, you know, soil amendments in this case, but we have to talk a lot about water and then all of the different treatments that are available for water. You know, like you don't use chemical sanitizers in the water if you have problems with the water because in the aquaponic for example, you have to find other solutions.

So, and that is my upcoming project. I'm pretty excited about that. We need to develop something that is, it will work for growers, you know, they need to implement practices that are doable and then that are realistic, but it's still, they're following safety practices to, you know, to ensure that what they are growing, what they're producing is safe. We had a big outbreak, I would say big outbreak last year with salmonella on a hydroponic vertical farm. So that was the first documented outbreak related to indoor growing. So, and that raised, you know, the question, is it a safe growing system? It's not a hundred percent safe. You know, there are risks that need to be considered.

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Jacob: Basically what you're gonna do is take something... So what's happening now is guys are out there and they're harvesting cucumbers and whatever else. They're growing tomatoes in their aquaponic or hydroponic system and it's supposed to be relaxing when you harvest these things. I know, you know, outside of farming, guys, outside of farming, when I go to my garden, it's therapy for me. I go out there, I harvest my fruits and vegetables, they touch the ground, I pick 'em up and I give those to my friends and I don't eat those, but--

Camila: And that is not a good advice, you know? You don't harvest dropped produce.

Jacob:

That's right. You give it to your friends. And so it's supposed to be relaxing, but right now it's kind of tedious 'cause we're not wanting to touch things that have been in water, and if fish are involved, you basically need to take a shower in between 'cause these jokers are nasty. And so you're just trying to make their job a little bit less stressful is what it sounds like.

Camila: Yeah. Well, making their life, you know, easier in the future because, you know, all the stress related to, you know, foodborne outbreak or, you know, a recall, it's a lot of stress than, you know, implementing some practices here and there to make your life a little bit difficult. You know, I would say that I think it's a good habit. I think we all learned with the covid that washing hands, you know, it's a great practice to, you know, avoid contamination, getting sick and everything. So that's why we say, I think the first lesson here is that harvest [indistinct] they need, like, they need to know that they have to wash their hands, you know, whether they're, when they're touching the fish or they're doing anything else. And before harvesting produce or before handling produce, in any case, they need to wash their hands, you know, that is the first step.

Olivia: And it'll save 'em money in the long run too. It's not just about eating clean food, it's about helping the farmers continue to make money and, you know, not lose a whole crop because of contamination.

Camila: If you think about, you know, implementing a whole food safety program in the farm, it keeps everything organized. You know, on the long term you see that things become easier and you know, everything, you learn new things and you implement new things and in a few months you see that it's part of your routine and it's not difficult anymore.

Olivia: And then if they want to go further and get different certifications, it's just already there, they're already doing it.

Camila: Yes. And they do, you know, aquaponic, hydroponic growers, they also being inspected by the produce safety rule. So they fall under the produce safety rule because they grow fresh produce. So all the, you know, their requirements for them to do to be qualified, to be inspected, they follow the same. So they, if they make more than 25k or you know, if they're not exempt, they will be inspected. If they wanna sell their produce, there

are the buyers market requirements, you know, they need to fall into that too. So gap certification, primary certification and so on.

Olivia: And those open up a lot of doors for them as well. I know I've seen indoor ag get a lot of attention and it's good to see now that the research is coming in to kind of back up some of these practices. And it's great to see because we do have a lot of urban areas in, well the world, but here in the South that's often overlooked. We still think of it as super rural down here, and I feel like I keep maybe throwing the South under the bus. There's probably a lot more aquaponic producers and hydroponic producers here than I'm aware of. So can you talk about some of those? How many are there here?

Caroline: There's not too many, mostly I think due to the fact that, you know, there's not a lot of research about it. People don't really know what they're getting into, but providing more education about that will certainly help them to become more common. I just know from my work in aquaponics that it's definitely easier for, or I guess more worth it for a person who's already producing fish to kind of adapt their production system to aquaponics as opposed to like someone who's growing plants to add fish to their system and do it that way. Just in terms of, you know, economics, it's cheaper to just buy a bag of fertilizer to do hydroponics instead of--

Olivia: Is it? 'Cause that was kind of my next question. How should we, as this emerges and as research comes out to support the growers interested in it, how should we direct them, and just for their own understanding, which would be the most economical?

Caroline: I think it depends on what your goal is. So if you already--

Olivia: To make money? What if that's the main goal?

Caroline: Yeah. So right now with fertilizer costs being so high, it might be better to do aquaponics and use that as your fertilizer.

Olivia: That's what it sounds like.

Jacob: Is feed cheaper?

Caroline: Fish feed is based on soy and soy is grown with fertilizer, so soy prices are increasing, which means fish feed prices are increasing. So, but if you can use like alternative feed sources and I know there's a lot of research being done on that, using algae and other kinds of things to feed the fish. There's research kind of trying to close that loop to make it like a really closed system. So something that you grow to feed the fish and the fish will make waste to feed the plants, that will kind of keep that circle going.

Jacob: So aquaponics, it's this great and wonderful thing that everybody's been working on and we grow a lot of catfish in Alabama, especially in West Alabama where Olivia works. Is that a good fish to use? Can we use catfish? Do you just drop a pipe in a pond and you're like, I'm aquaponics now or you know, how does that work?

Caroline: We've done a lot of research on tilapia. I know catfish are kind of the standard, you know, fish grown out for aquaculture here. So we haven't done a lot with using catfish for aquaponics. They're grown mostly like in ponds out in the field. So we've done a lot with tilapia and growing them in the greenhouse. They're a tropical species so you can grow them in very warm areas. And we do that so that we can grow them kind of year-round so that they'll like produce waste year-round so we can grow year-round in our greenhouses. Aquaponics tends right now to stick to freshwater species because plants really don't grow well when you have a high salt concentration, you know, there's research in the works for kind of trying to expand to either low salinity fish species or shrimp or something like that.

Jacob: That's right, 'cause I remember working at the fish farm, we were always salting ponds and doing all this stuff and I'm like, these are freshwater fish, while we throw salt in there and they're like, just do it. And I'm like, okay, that's what I did.

Caroline: Some salts are good though because I know that, so like we use potassium chloride for the fish to keep them healthy and that just provides more nutrients to the plants. But like sea salt is what you don't want.

Olivia: I think that was all we had. I think we covered a lot for our growers. If they're interested in learning more, they can find you for sure, Camila. And then Caroline, do you want to give your email address if they have questions?

Caroline: So you can reach me at ceb0116@auburn.edu.

Olivia: Thank y'all so much for coming on today. Thank you for listening, too. If you want to rate and subscribe, if you're enjoying this podcast, you can do so on any of the outlets that you're listening on. And for updates you can follow us on [farming_basics](#) on Instagram.

Jacob: Oh, and download our Farming Basics app. It's super cool, it's got calculators and all kinds of cool stuff. You can call me directly and we can talk about podcast stuff or anything you wanna talk about, Christmas tree farming, which I'm kind of getting into 'cause I really like cutting my own Christmas trees. So hit us up. We're all on the app.

Camila: And if you're a produce grower and you are interesting on knowing the quality of your water, microbial quality of your water, we have just launched a program earlier this summer for the AgWater Safety program. Then you can reach out to us. There is my contact here and we can do offer free water testing for you and an educational services and everything. So please reach out to us if you have interest.

Olivia: Yes, we are super excited to be able to offer that now to the state.

Jacob: Free is good.

Olivia: Yep.

Announcer: This has been a production of Alabama Extension at Auburn University.

