CAS Agriculture Podcast
30 Brave Minutes, February 15, 2020

Producer Richard Gay, Associate Dean of CAS: Welcome to 30 Brave Minutes, a podcast of the College of Arts and Sciences at the University of North Carolina at Pembroke. In 30 Brave Minutes we'll give you something interesting to think about. Joining the Dean of the College of Arts and Sciences Jeff Frederick are faculty from the Department of Biology. With him are Maria Pereira, Amber Rock, Rita Hagevik, and Bryan Sales. Now get ready for 30 Brave Minutes.

JF: So here's a great quote about assessing the existential differences between Northerners and Southerners and it comes from a Mississippi woman named Julia Reed, who gets that to understand a Southerner, the place to start is with the stomach. Reed says this: "If you ask any Southerner to name the best meal he ever ate, he will invariably recall something that his mama or grandma made at home. If you ask a Yankee about the best meal he ever ate, he invariably will name a four-star, impossible-to-get-a-reservation-at restaurant and usually not even mention the actual food. And there it is. The simplest and yet most complex definition of who we are as Southerners. The other half of that equation is tied up in the reality that the foods we eat are most often grow right here in the region. And while on the household level that might mean the box garden out back, the containers of tomatoes on the patio, or the herbs on the windowsill, on the larger level, it means farming. As late as the dawn of the American Revolution only one in five American farmers had a plow, meaning agriculture was local, personal, back-breakingly physical, and critical for survival as one's ability to produce a crop, store it, and ration it was directly proportional to feeding one's family all winter long. Machinery in farming was a critical development. As late as 1830, the typical American farmer was still broadcasting seed, hay was still being cut with a hand, and bundled by a rake, and corn was harvested with hands and hoes. Cotton gins, threshing machines, mowing machines, and Cyrus McCormick's improved reaper started the face of change. And Post Civil War, American manufacturing and engineering expanded, creating discs, harrows, planters, and soon enough milking machines, and eventually, with the 1925 Farmall tractor, affordable mechanization with an ever-growing number of attachments, like harvesting devices, for example. In the years since, farming has become more technical, more scientific, more sophisticated, and just as critical, though in a slightly different context. This broadcast is originating in the largest geographic county by land area in the state of North Carolina, the state with the second largest rural population of any state in the union. Despite two hurricanes since fall 2016, about one of every three total acres in this county is under cultivation. Taken together the cash receipts from farms and buildings and the equipment that produces grain and beans, broilers and hogs and everything in between, agriculture in this county alone is worth almost 1.3 billion dollars. In all of its parts and pieces, it is a 76 billion dollar value-added North Carolina business. And it isn't

declining. Agriculture is growing and it is more critical than ever. In this state, it supplies 70% of the state's income and employees 17% of the state's work force. North Carolina is around seventh nationally in farm profits and leads the nation in several commodities. Last time I looked the state ranks first in the nation in farm cash receipts for tobacco, sweet potatoes, second for turkey and hogs, and third for cucumbers and strawberries. And basically is in the top 10 for just about everything else. More to the point, we know that not only is agriculture not declining, it is actually facing a mandate for expansion and improvement. Today, the world's population sits at 7.3 billion. By 2050 the population across the Earth will reach 9.7 billion. At the turn of the next Century the world will have over 11 billion people and one thing they will all have in common is they're all going to need something to eat. Our topic today is agriculture and joining me are Maria Pereira, Amber Rock, Rita Hagevik, and Bryan Sales. Welcome everybody.

Bryan Sales, Maria Pereira, Amber Rock, and Rita Hagevik: Hello.

JF: So tell us about your research areas and how they interact with agriculture. Bryan, get us started.

BS: All right. Well, my research is directly related to agriculture because I have a degree in agriculture. What I look at is soil amendments, specifically organic soil amendments for crop production and yields. I have worked on blueberries, mainly, so I am familiar with blueberry production, raspberry, and blackberry production. What I do is I look at the physical and chemical characteristics of the soil amendment and then measure plant growth. So, the physical characteristics might be particle size, chemical characteristics might be pH of the amendment, nutrient release, things like that. So the effectiveness of the amendment will depend on the soil that the plant is grown in, so you can effectively tailor your organic amendment to the soil and to what crop you are going to want to produce. My main focus of research is the sustainable organic amendment called biochar. You can make biochar from anything that you can compost. It is just organic matter. It is organic carbon, but instead of composting it when the carbon will bind with oxygen and go back into the atmosphere as CO2, if you heat this organic matter to a temperature of about 700 degrees Celsius, it will decompose your organic matter, but you don't allow oxygen in there so it doesn't actually combust, so that carbon is sealed in its original form, so you don't lose carbon back to the atmosphere.

JF: 700 degrees Celsius. Kids, do not try this at home.

BS: Biochar is a really new, innovative organic tool that is recommended by the USDA, specifically in the eastern part of the US for crop production. It will stay in the soil for up to 1,000 years, so it is an effective way to sequester carbon, but is really, really great as far as

nutrient retention and water retention, which are really important tools as we move forward with agriculture.

JF: What about the rest of you all?

MP: So, I also have some degrees in agriculture and I have two small projects going on. The first one is when growers think about transition from traditional agriculture to sustainable agriculture, they are puzzled, confused, lost. What should I do? How can I start? So I am trying to implement the plan with some initial steps where the grower can answer this question: what can I do on my own farm, one step at a time, moving toward sustainability? The second project I have going on with one of our students in the (Research Initiative for Scientific Enhancement) RISE program is, like Bryan, using biochar, but in this case I am using strawberries. I am simply looking at different amounts of biochar, how will that impact all the agricultural traits of strawberries? In the literature it has been known to increase the resistance to a fungal disease. I am also looking at higher yields, better quality, sweeter strawberries, bigger. There is not much literature between strawberries and biochar.

JF: So a more productive, resilient berry?

MP: We will see what we can obtain. I don't know.

JF: A baker's cross?

MP: Yes

JF: Amber?

AR: I like to describe myself as agriculture-adjacent. My research focus is in freshwater ecology, so I study lakes and rivers and streams and things like that, but the reality is that everything we do on the land affects these aquatic ecosystems. So, for example, every time we put fertilizer on an agriculture field, a certain amount of that fertilizer washes off or runs off into our waterways. And those excess nutrients can cause something called eutrophication, which is just a build-up of nutrients in the water and that can lead to, in extreme cases, things like Algal Bloom or other negative effects on fresh water ecosystems. It can affect the algae that grow in the lake or the river and then those effects can be felt the whole way up the food chain and the whole way through the food web. So I'm primarily interested in studying those effects on aquatic ecosystems.

RH: Okay, I am the graduate director of science education here at UNCP and my interest in agriculture research is I train science teachers and help them think of effective ways to teach STEM (Science, Technology, Engineering, Mathematics) to their students. I am very interested in engaging minority students and developing science identities in STEM so that maybe they will want to go into science and solve some of these problems. My specific area of research is outdoor science and the use of technologies in the out of doors: GIS, GPS, bio-sensors, and I work with bees and habitat enrichment, and also with the UNCP campus garden apiary.

JF: We have so many rich perspectives and vantage points. So, let me throw out kind of a big one at you. From where you sit, what would you identify as some of the critical issues for agriculture as we head deeper into the 21st century?

BS: Okay, I can start with this. I think a really big issue that we have is just our natural resources: fresh water, arable soil and nutrients. We are just running out of enough land to farm. We used to farm a land, and when we depleted it we would move on. That is just how it was done in history. Now we don't really have anywhere to move to. A trend that we have seen is that while there might be less farms overall, there is more intensive production that is coming out of fewer farms, which is actually a good thing. I think a lot of our production is going to move to a really intensified production, getting a lot more out of small spaces. We're going to need to look at arable land, fresh water. 70% of the earth's surface is covered in water, but only 3% is fresh water, and of that, only 1% is not tied-up in ice or glaciers. We actually have very little fresh water.

JF: So you are indicating that we have to produce more when we don't have a lot of additional territory to work on. We've got to get better with the land that we have.

RH: Though globally we might want to think of this as the food-energy-water nexus. It’s what people are talking about. So how does food and energy and water - how do they interplay with each other, and especially with shifting climates, and shifting patterns of weather? What does that mean to different people who live in different places?

AR: So I will just add on a little bit to that. Again, from my perspective as someone who studies fresh water, just to sort of echo what has already been said, but I think sustainable water use is going to be a really big issue moving forward and we have several examples in the United States of, sort of over-using our water sources relative to how quickly they are replenished or how quickly the water is processed and cleaned up, and that sort of stuff. So I think, really, figuring out ways to use water more sustainably moving forward is going to be huge, especially for regions of the country like the great plains, which are draining the aquifer underneath the great plains very quickly, and also in areas like southern California where they move water over

200 miles from the Colorado river to farms in southern California. So coming up with ways to grow crops but also use those resources sustainably is going to be huge.

JF: Getting more seeds is the ground is barely even the starting point. There is so much science and technology that has to be applied to this problem. Everything from how do we get the same amount of land to produce more to what are the effects of the changing nature of climate to how can we re-use our fresh water in such a way that neither depletes it, but also allows the crop... This is not an easy thing that you guys are working on!

All: No, it's not, not at all, un uh...

BS: I think we are going to move in a lot of ways back to some of the traditional agriculture methods, where we need to conserve a lot and create healthier soil, so that we can get out of it what we want to put into it. Then, recycling nutrients, as well, I think is going to be really important, because a lot of times when those nutrients which we all know goes into a water system, be it a lake or the ocean, it is just lost. You can't extract that back out, so the better we are at that, the better we will be at agriculture.

JF: So this looks like a good point to talk about some terms. What's conventional or traditional agriculture? What's organic? What's sustainable? How do we separate those sorts of categories?

MP: So conventional agriculture would be one in which there are greater yields but less energy is lost. On the extreme we will have the organic farming where is the system that is the most energy efficient, but it's under the umbrella of sustainable agriculture, as an umbrella which has different types of agriculture under it. Organic is one of them. So if we would think about what is sustainable agriculture itself? It is a system where farmers are concerned about the management. The management of the soil, the water, the nutrients, and they aim to fulfill the needs of today, but don't deplete the ecosystem for future generations. So, it's a management system, while the organic farming is more concerned with using only the natural resources. No man-made amendments, fertilizers, herbicides, and it is more a concern to enhance the biological system, the biological diversity, recycling the nutrients in the soil, which Bryan said is to increase soil health and soil life.

BS: And I think that these systems that we have talked about: traditional, sustainable, and organic, are all just tools that farmers have to increase their production and take care of the land. We used to have more of a choice, where you could choose to use one of these systems. But now everything is much more limited, and all of those systems are just kind of merging together and just trying to get a lot of the best production that farmers can get out of them. They are much more apt to use sustainable practices if it is easy and is locally reasonable to increase their

production, maybe add a little organic here, but then still incorporate some conventional practices as well.

JF: And then there is the reality that farmers are also business-people, right? So in the end they have to produce a quantity of a crop they can sell to a market that can net them more than what it cost to produce that crop. So, are there farms that might have, across a large amount of acreage, conventional, sustained and organic processes, all on the same farm?

BS: Definitely. They are, often. A farmer is going to do what increases the yield, so they may use a sustainable or organic practice and incorporate it into their whole farming practice, and then some farmers will have a certain part of their field that is just dedicated to organic and another that is dedicated to conventional, because they are supplying two different markets and the value of those crops, the way they are produced, will just differ. Some people are going to buy just because it is organically produced, but there are plenty of things that are just not feasible to produce organically, as well, so you will get a variety.

JF: And in the middle of all of that there are factors that cannot be controlled, for example weather, which is really hard to imagine. We are experiencing a little of that in North Carolina today. But market prices, and when different nations impose tariffs, it affects farmers on the local level in ways that are less predictable than others. Where do you see the trends going? Is the trend whatever works best for my farm, or is the trend to go in a direction of more organic and sustainable?

RH: Well the average farmer in the United States is 55 years of age, so when we look at the United States and farm and farm systems, of course the goal is going to be to get young farmers and support young farmers coming into the business of growing food. And as we know, many young farmers are dedicated individuals to farming, not only to make a profit, but also to make a difference in the world that they live in. So, what we can think about when we think about agriculture is re-imagining agriculture, and reaching forward to looking at more regenerative practices in agriculture so that we can reduce our climate change, or our carbon footprint. But also the entire world. Many people believe, and to get the actual numbers, there actually is enough food in the world now to feed everybody, even 11 billion people, so it is not necessarily our knowledge of food, how we grow food, that is the issue, but it is more these bigger things that we need to think about, like supply chains, food waste, and how we transport the food around the world. So, these are the big questions for agriculture looking into the future.

Chancellor Robin Cummings: This is Chancellor Robin Cummings, and I want to thank you for listening to 30 Brave Minutes. Our faculty and students provide expertise, energy, and passion, driving our region forward. Our commitment to Southeastern North Carolina has never been

stronger through our teaching, our research, and our community outreach. I want to encourage you to consider making a tax-deductible contribution to the College of Arts and Sciences at the University of North Carolina at Pembroke. With your help we will continue our impact for generations to come. You can donate online at uncp.edu/give. Thanks again for listening, and now back to more 30 Brave Minutes.

JF: You are listening to 30 Brave Minutes, a broadcast service of the College of Arts and Sciences at UNC-Pembroke. I'm Jeff Frederick and we are talking agriculture today. Our panel includes Maria Pereira, Amber Rock, Bryan Sales, and Rita Hagevik. So let's look at a couple of large issues and how they fit together as puzzle pieces. What about plant genetics? What about water quality? What about other factors that are impacting agriculture realities? And maybe even local farms?

MP: I would like to speak about the genetics portion, as we need to concentrate on our crops and look for genetic diversity. And when we look at the genetic diversity of our crops, we plant breeders will look at ways to increase the crop yields, to reduce the costs, and of course to make these plants more drought-resistant and disease-resistant. So, if we can do that, then perhaps we can get by having less arable land and higher yields, even though Dr. Hagevik just mentioned we produce enough food to feed the 11 billion people, there is a notion in the world that people are starving and it is not enough food.

JF: I am interested in some water issues as well. Amber, you talked earlier about run-off and a variety of other factors that could degrade fresh water quality. Can that be repaired? How do you take a body of fresh water and improve some of the analysis that you're seeing that is saying that we've got to make some changes?

AR: Yeah. That's a great question and one that we haven't really figured out the answer to yet, I don't think. Brian alluded to this a few minutes ago, but essentially once all of those nutrients runoff into a body of water, a lot of them end up just settling down to the bottom. They end up in the sediment at the bottom of a lake or stream or something. And so, they end up being these huge pools of nutrients that are essentially now unavailable because we haven't really figured out a way to get them back, because mixed in with all of that is anything else that ends up in the lake and river. Potentially other contaminants or pollutants, and how do you separate all those things out? We don't really know. So in terms of reversing eutrophication, which is the term that we use, that's a big area of interest. Definitely. It's a concern but I don't think it's something that we've really figured out how to do yet, and whatever the plan ends up being, it's probably going to be very expensive and potentially time-consuming and the question of how much return we will actually get, we can't answer yet.

JF: But science has gotten to the point where we can identify when it is happening, but we're not necessarily yet clear on how to reverse it.

AR: Correct.

RH: There is also quite a bit of research that is ongoing. Some really interesting research on using plants and different types of plants to actually clear the water. So plants, themselves, and if we use the ecosystem services that are already in place in our environment, we can use that then to help address some of these problems.

BS: The way that water becomes clean is it filters through the soil and organic matter. It pulls out all your herbicides, microbes, and makes its way down to the aquifer, and we have wonderful, drinkable, water, but so much of that water is not passing through our soil profiles anymore. It's getting to the land and running directly off and that's a lot of our management practices in agriculture. And then the costs for cleaning up water is like reverse osmosis. They do a lot of this in Saudi Arabia and the Middle East and they're very wonderful at it, but it is a really energy intensive process that we would be better to avoid, than try to fix.

JF: So one thing that is potentially changing in the Southeast North Carolina agricultural landscape is the introduction of hemp. Hemp has industrial, particularly for some people, medicinal, and a variety of other consumer potential applications. It's also a pretty unregulated environment, now, although we do know that hemp grows pretty good in soil where tobacco used to grow, and we have a pretty fair amount of that. What are your thoughts on hemp moving forward and what the next developments will be there?

MP: So I would like to speak of the hemp cultivar or should I say subspecies versus the crop that induces psychotic effects, which is marijuana. So both of them, amazingly enough, are from the same family, and the same genus, which is cannabis and what they are, are different subspecies. They both produce the famous CBD oil, which has very good nutritional facts, health, you know, it's good for health and a myriad of things. The difference is on the THC contents. So hemp has low THC content, no more than 0.3% while marijuana can go anywhere from 5 to 30 percent, but you can obtain oil from both, and have good effects and good uses from both. Now, hemp itself can be grown in almost any soil, any climates. It doesn't deplete the soil very much. It does not require a lot of water and the plants are excellent both for fiber, for seed consumption, while marijuana, which is a different subspecies, it needs a lot of attention to pH, water, nutrients. It needs a lot of space because they are mainly grown for their leaves. So you need a lot of area around, the environment has to be just perfect to produce that amount of oil with a THC compound.

BS: Yes, I think that Maria is right. One of the biggest challenges is making sure you grow these plants and they have below the limit of THC, which I'm still not sure how they arrived at that actual concentration and what makes that the perfect number. But I think that's just going to be a result of breeding and they'll get that figured out. It's just it's a new industry, but I think it's going to depend for North Carolina, what other crops they want to grow here. Like how much space they have and economically, the world market. You know, who else is supplying it? Is it even feasible for us to do? And does it grow in our soil type? We have a pretty acidic soil here. So I know that it can grow fine, but it usually likes soil more towards a 7 pH and tobacco likes something closer to 5.5-6. There is a little bit of a difference there and until this really gets tried-and-true and we figure it out, there's a lot to investigate. But it's a great opportunity.

JF: So let's provide everybody some good cocktail party information. What's a simple truth about something related to soil or water or seed or pests or farming that most folks don't necessarily understand but they should?

BS: Well, as far as the soil goes, it is about 45% minerals, 5% organic matter and the rest of it is pore space. So half of it is really pore space. That's going to allow water to drain, so if it's wet, it's going to be all the pores are full of water. If it's dry it is all going to be full of air. So I think a lot of people don't see soil as 50% of it as empty and that just really goes to show how important compaction is and if we drive over it or we walk over it, how much we can change the soil.

RH: Well, one out of every three bites that everybody eats every day is due to a pollinator, most likely a bee. So everybody, plant wildflowers, many different kinds at many different heights. The more the better, and the more different types, the better, because without bees and pollinators, we may not have a whole lot of agriculture to be able to grow.

JF: I noted recently that somebody produced a document where they called the bee the most important species on the planet.

All: Yes, yep, yeah, right.

JF: What about the rest of you all?

AR: So in terms of water quality, I think the simple truth, I would say, is that lakes and rivers, we think of them as being the lowest point in the landscape, right? That's where everything drains to and it's just really important to keep in mind, right? Everything that goes on the landscape could potentially end up in a body of water and that has implications for agriculture, but even drinking water quality, recreational water quality. As you move forward with

agriculture, and with everything, just keeping in mind that basically everything you do on the landscape can impact our fresh water resources.

MP: And I would like to add for the individuals that are listening to us. One thing that we all need to try to do is never to leave the soil bare because that will lead to erosion. So, if farmers would use cover crops when they're not planting for the cash crop and also having a mindset of not growing the same crop year after year after year in the same field, because if you do that practice, you allow the pests and the disease to build up on that soil. So basically next year you are starting your crop again on an infested field. So keep in mind that crops need to be rotated from one field to another, even if the farmer is completely conventional. At least these two practices of moving the crops in the fields and covering the field at all times. And both those are critically important.

JF: So UNCP launched its own agriculture program last August within the biology department. Everyone is very excited about that. What are some interesting elements of that program that might interest our listeners?

BS: Well, I can speak from the plant side of the agriculture. We're doing some really interesting projects and classes. One of those is Techniques in Horticulture. This is really open to all the students on campus. So you do not need a prerequisite to take this class. This class is to encourage people to grow plants, to learn how to garden, help to feed themselves. We do a lot of interesting techniques in there, such as grafting, asexual production, direct sowing. We also have just put together a really nice Agriculture Club. There are a lot of students that are interested in agriculture, but may not want to declare it as their major. We have seen a really big response from students at UNCP who are interested in growing plants and in agriculture and are really interested in food production.

RH: There are lots of great opportunities for students to get involved in the campus garden apiary. We do outreach programs. We also do research. We communicate to others about how they can do things for themselves at home. We have student STEM programs that the students can get involved in and some of the students in the Ag program help and assist with those types of activities, so they seem to really enjoy the educational communication as well as the research piece of the program. And since agriculture is global, we are working on connecting our students globally so they can look at Ag from a global perspective and some of the research practices and Ag practices that we can learn about in other parts of the world and bring back right here to the Southeastern part of North Carolina.

JF: I'm proud to be in the small collection of deans who put on the bee suit and have done some actual work in the apiary.

MP: Yes, and from my perspective, I am so excited because due to a small grant coming from the dean's office, we were able to "infiltrate" ourselves into the high schools and buying them some pots and soil and seeds.

JF: Containers, you mean. You weren't buying them pot. (Everyone laughs)

MP: Yes, window containers. No, not that pot. We have these students all excited growing plants and I believe that when the students look at the seed in the light that it's a green plant and if they don't take care of it, this plant will die. I have noticed this students calling these plants "my babies" and so I can see now that all the students surrounding our campus will now have an opportunity to follow that passion of being around plants and growing plants. I can't believe that they are so much more pleasant to deal with, and I am sure they will end up here with us in UNCP Ag Program.

AR: And for me, because of my background as a field ecologist, and somebody who's outside a lot, I get really excited and passionate about getting students out of the classroom and into kind of, nature or out into the world, so to speak. And so I'm really excited for the potential for these Ag classes to get students in the greenhouse, in the garden, maybe out working with local farmers. We are in the process of hiring someone to teach some animal science classes, so there's definitely potential there to get students putting their hands on some cows or some goats or you know, anything like that and really learning firsthand some of these skills, and those things that are going to be really important to them in their careers. So I'm really excited about that aspect, as well.

JF: Wonderful! This has been great fun. Thank you all for joining us today to talk about agriculture and farming. Join us again next time for another edition of 30 Brave Minutes.

Richard Gay: Today's podcast was edited by Richard Gay and transcribed by Janet Gentes. Theme music created by Reilly Morton.

presented in the original recording has remained accurate due to advances in research, technology, or industry standards. Thanks for listening and go Braves.

Frederick: Good job everybody!