

## Transcript: Plant Breeding Stories Podcast

### S4 E9 Dr. Julia Sibiya



[Theme music plays]

**Hannah Senior:** Welcome to this episode of The Plant Breeding Stories Podcast, where I talk to leading lights in plant breeding, asking what they do, what makes them tick and what fascinates them about the world of plants. I'm your host Hannah Senior of PBS International, world leaders in pollination control. We design and produce specialist pollination bags and tents, used by plant breeders and seed producers all around the world. And through this, I've been privileged to get a unique perspective on how plant breeding globally affects our diets, farming systems and the environment. I'm excited to share a little of this with you, as we meet some of the amazing people who make plant breeding their life's work.

**Hannah Senior:** Series 4 will be the last in this podcast. And it has been the most incredible experience to dig into so many different aspects of the plant breeding world and literally the world. If you're listening to this, you're part of a community that spans the globe from Albania to Zambia, Adelaide, Australia, and Ames, Iowa to Zurich.

**Hannah Senior:** Julia Sibiya is an Associate Professor of Plant Breeding at the University of KwaZulu-Natal in South Africa. Her research and work is focused primarily around sorghum and maize, in particular using biotechnology tools to progress their variety development efforts. She's a vocal advocate for plant breeding, committed to increasing awareness of this discipline & growing networks within it, as well as encouraging young people to consider a career in plant breeding & agriculture. I hope you enjoy it.

[Theme music plays]

**Hannah Senior:** It's fantastic to have you on the podcast today Julia. So to set the scene, could you introduce yourself and tell me a little about your role?

**Julia Sibiya:** Okay. Thank you, Hannah. My name is Julia Sibiya. I'm an Associate Professor of Plant Breeding at the University of KwaZulu-Natal in Pietermaritzburg, South Africa. I'm also an academic leader for the production sciences cluster in the school, which includes disciplines of plant breeding, crop science, horticultural science, plant pathology, and animal and poultry sciences. And currently I'm also the vice president of the African Plant Breeders Association.

**Hannah Senior:** I always like to ask the question about how did you get into plant breeding and particularly what was your background, did you grow up with an interest in plants? Did your schooling lead you to this? Can you sort of set the scene for us about your background?

**Julia Sibiya:** I was born and raised in Zimbabwe. I did my primary and secondary education there, as well as my bachelor's degree. I wasn't interested in plants initially, I wanted to be a medical doctor. However, for one to get into medicine in Zimbabwe, you had to have very high points during your A-levels because the competition's very high and the places are limited. So I wasn't able to get in. So I settled for my third choice, which was agriculture. And in agriculture, I actually wanted to focus on animals initially because I thought animals were closer to humans, to medicine that I wanted to do.

**Julia Sibiya:** So when I joined the University of Zimbabwe for my bachelor's degree, the first year courses for animal science and crop science are basically the same. So this helps you to switch if you need to switch like in second year. So I switched in second year because I realized I actually wanted to work with plants. And also when we were doing some of the plant courses, I realized that some of the techniques, the tools that we were using were actually similar to what's used in medicine.

**Hannah Senior:** And where did you study your masters? It wasn't in Zimbabwe, was it?

**Julia Sibiya:** After I finished my first degree, I did my master's degree in the United States at the Ohio State University. And there I was working on plant pathology. I

majored in plant virology. And again, it was quite interesting because I realized that plant virology also incorporates genetics, molecular biology and all these biotechnology tools. Then I went back to Zim' and I joined the University of Zimbabwe as a lecturer. Then it was from there that I then decided to do my PhD and I opted to go to South Africa to do my PhD. And I decided to switch again to plant breeding now, but still working with plant diseases and incorporating some of the biotechnology tools.

**Hannah Senior:** And what made you choose to do your PhD in South Africa?

**Julia Sibiya:** So when I looked at the curriculum that they had in South Africa at the African Centre for Crop Improvement at the University of KwaZulu-Natal, I saw that they were actually training PhDs in plant breeding, but also with applications of biotechnology. So having taught plant pathology or working with plant diseases, one of the control measures for plant diseases is actually host resistance, which is plant breeding. So I decided, "okay, I can go and do plant breeding, but still work with plant diseases and also apply biotechnology tools to my plant breeding". So that's when I then decided to apply to the University of KwaZulu-Natal to join them. And I was accepted also on a Rockefeller Foundation fellowship. And this is how I ended up in South Africa doing my PhD.

**Hannah Senior:** Did you intend to go back to Zimbabwe and if so, how did you end up staying in South Africa?

**Julia Sibiya:** Okay. So the program at the African Centre for Crop Improvement was like a sandwich program where you would do two years of coursework, develop your research proposal. So they equip you with all the theoretical background that you need to be able to do your research, then you would go back to your home country to do the research. Then you have at the end three months to just complete the PhD writing up back in South Africa.

**Julia Sibiya:** So after the first two years in South Africa, things we're not going well in Zim' at that time as well, the environment was not really good. So the director of the African Centre for Crop Improvement then said for me and my colleague from Zimbabwe, we were not going to go back and do our research in Zimbabwe. We had to do our research in South Africa. So we wouldn't waste time because at that time in Zim' there were a lot of shortages for almost everything. So he didn't want us to spend time in queues, trying to get fuel, even to get to your research trials and the like, so we ended up doing our research in South Africa. When I did my research in South Africa, before I actually finished the PhD again, the director told me that he wanted me to join the academic staff of the African Centre for Crop Improvement. So this is how I ended up again, staying in South Africa.

**Hannah Senior:** I know you now work primarily with maize and with sorghum - but I'd like to take a moment to talk about Sorghum particularly as a crop, to fill in any gaps for listeners. Can you give me some background information about it?

**Julia Sibiya:** So for sorghum in particular, sorghum is probably the second most important cereal after maize in Sub-Saharan Africa. It's a crop that you can also produce in the dry areas. So it's preferred when maize fails. Maize is the staple for most of Africa and you find people growing maize in all different environments, even in environments that are not conducive for maize. So when we have droughts and the like, and maize fails, usually sorghum, you do manage to harvest something. So we encourage farmers to adopt sorghum.

**Hannah Senior:** And what are you focusing on in your Sorghum research?

**Julia Sibiya:** I'm focusing on two types of sorghums. They are the ones that are called the sweet-stemmed sorghums used for biofuels and for sweet-stemmed sorghum. I was actually approached by a small company that is here in South Africa that wanted to produce biofuels and to work with some communities, contract them, to produce the

sorghums and then buy the sorghums from them and produce biofuels. So they wanted me to do research on whether we can develop hybrids for these sweet-stemmed sorghums. So they want high yielding hybrids, and also to look at whether it's possible to have a dual purpose sorghum, which can produce both grain and sugar, which is a bit difficult because these traits are not easy to work with. They are negatively, sort of, correlated. So when you increase sugar, you decrease the grain and the like. So we are working on trying to develop a selection index that can assist us in the selection of both traits simultaneously.

**Julia Sibiya:** So where we can give an economic value to each of the traits, depending on which trait we want the most. So I have students working on that and for the hybrids, we're also trying to develop our own, because sorghum is a self pollinating crop, and it is a little bit of cross pollination, but it's mainly self pollinating. So it's not easy to develop hybrids. So we are using a male sterile system. So you need different types of lines, what they call the A-line, the B-line and the R-line. So we are trying to develop our own A-lines, which are the male sterile lines that we will use as the females in our bridging, so that we can develop the hybrids.

**Julia Sibiya:** Then I also recently have another project that I am collaborating with UC Davis. It's focusing on enhancing productivity, as well as nutritional quality of grain sorghum. So now for that, I'm focusing on the grain sorghums and trying to enhance the productivity, even under drought conditions. So for this one, we are looking at trying to improve iron and zinc. Then for proteins, we are looking at lysine. And we also look at other micronutrients that may be important to improve.

**Hannah Senior:** Now, you mentioned that one of the things you're trying to do is to bring together these two characteristics that don't seem to want to be in the same plant, the high sugar content and the high grain production. And I wonder if that's one of the reasons that you think biotechnology might be a useful tool.

**Julia Sibiya:** I think with biotechnology, we are able to find the genes that control these traits or the QTLs if it's polygenic. So if we can find these QTLs and see if we can map them and apply biotechnology tools, maybe we might be able to manipulate them, especially with the new technologies that are currently available now, the gene editing and the like. We might be able to edit and be able to increase both at the same time. I don't know. [She laughs] It's something that we are willing to look at and to just see if we can go around this complicated correlation that is there between these two traits.

**Hannah Senior:** Are there many restrictions around varieties derived using these biotechnology tools like gene editing or transgenics? Is it possible to release them - for example like in the US or is it more tightly controlled like in much of Europe?

**Julia Sibiya:** For Zimbabwe, you can do research on transgenics or on GMOs, but they don't allow commercialization of the crops and they also don't allow any GMO crops into the country. For South Africa, you can do research on GMOs. You can also commercialize GMOs. And currently I know most of the maize that is being grown in South Africa is actually GM maize with the BT gene, almost all the soybean is roundup ready soybean. So it's also GM soybean. I think all the cotton is always BT cotton that's being grown in South Africa. So South Africa does allow, they have regulations regarding that. And there's rigorous testing of the GM products that has to be done before they can be released and the isolations and everything when you're doing the field trials. So they do have regulations in place, and they do allow, and it's commercialized. And most of the maize based products that we are consuming, they're actually from the GM maize.

**Hannah Senior:** I want to move on now to talking about the relatively newly formed African Plant Breeders Association - of which you are the Vice President. Can you tell me a bit about it and how you see it contributing to the plant breeding scene both domestically and regionally?

**Julia Sibiya:** The African Plant Breeders Association was actually launched recently 2019. So we've just had two meetings. The first meeting was in 2019 in Ghana, Accra. Then we just did the second meeting this past October, 2021 in Kigali, Rwanda. We're trying to bring plant breeders in Africa together. So it's a network of plant breeders in Africa, but also plant breeders from other parts of the world. The UC Davis African Plant Breeding Academy was actually quite instrumental in encouraging us to form the African Plant Breeders Association, notably Rita Mumm and Allen Van Deynze; they actually helped us a lot. So we have a lot of support from all over the world. We're working with private companies, we are working with CGIAR centers as well. In our conferences we've had people coming from the US from Australia from different parts of the world, UK and the like, so we hope that it will help us to form this networking with other plant breeders from other regions within Africa and outside of Africa.

**Julia Sibiya:** And we also hope that through the African Plant Breeders Association, maybe we can also jointly write research proposals for funding. And we can also try to lobby our governments, the African Union, and the like to support plant breeding, agriculture even more and try to influence policy wherever we can. And also use it as a scientific platform where we can share ideas, we can exchange ideas. We know what's happening in this country. What sort of research is going on? Can we collaborate? And that sort of thing. So we just hope that it'll also encourage even the young ones to pursue plant breeding, maybe at postgraduate levels as well.

[Theme tune plays]

**Hannah Senior:** You're listening to Plant Breeding Stories brought to you by PBS International, world leaders in pollination control. We're exploring the personal stories behind people who've dedicated their careers to plant breeding, helping us to more

productive plants, greater food security and more sustainable agriculture. Now back to the podcast.

[Theme tune fades out]

**Hannah Senior:** We've been talking about your role as the vice chair of the African Plant Breeders Association. And I wanted to know what are your hopes for the association in terms of the networking opportunities that you can see on a global perspective?

**Julia Sibiya:** With climate change taking place and all that happening, the challenges that we face are almost similar, whether you are in the UK, in America, you are in Africa. And so if we can network as different associations, we can actually help each other to address some of these issues. If I can say in Africa, I have to be honest, we are lagging behind in a lot of technologies, in a lot of how we can address some of the challenges that we are facing. And so by connecting, for example, with people from NAPB, we can do collaborative research where we can assist each other, and we can get assistance from those with the infrastructure or the skills that can help to sort of address the issues that we have and so help to solve these global issues that we are facing, which affect food security and nutritional security as well. So I think it's quite beneficial, these networking that can be formed through the different associations.

**Hannah Senior:** So one of the things that we were going to talk about, which I know you care very strongly about, is attracting more people into agriculture in the broadest sense, and then plant breeding specifically. So I'd like to talk about that. Tell me why is that something that you feel strongly about and why do you think it's a problem?

**Julia Sibiya:** Just looking back at myself, that I was so ignorant about agriculture in general, I didn't understand what it actually entailed. And so when you talk of agriculture, people quickly think, "Oh, farming, you're doing manual things and whatever, and whatever." So in the end, you don't get many students coming to fields in



agriculture, because they're not aware agriculture is actually a science, a real science that you're focusing on. I would like to actually raise awareness on the importance, one, of agriculture, especially with the challenges that we are facing, which are affecting food insecurity and malnutrition, which is a reality actually in most African countries. So we need to address this and we need people who can address this. So if we can train more scientists who can work to address these problems, then the better. Seeing that we have less students who are taking up sciences, especially agriculture. I'm really passionate about having more people come to agricultural sciences. If they train at those levels, masters level, PhD level, they are also able to innovate and run successful programs. And also they can effectively argue and influence policy makers. And maybe our governments can put in more money into research to improve these crops and improve the nutrition quality of most of our citizens as well.

**Hannah Senior:** What do you think might help to make people recognize, "Oh, you know what, actually, this is really interesting and really important. And there's a lot of scope to have an impact."

**Julia Sibiya:** We probably need to start maybe at high school level before students make up their minds on what they want to study at the universities. We also have a program where we go to the high schools, the secondary schools, especially the science faculty and they do some sort of science shows where they demonstrate the different things that you can do in science. And unfortunately we haven't done that much with agriculture. It's something that we can start thinking about where we can let the learners know what can be done in agriculture. We have the fourth industrial revolution, which has brought a lot of different innovations that can be done in agriculture, the biotechnology applications in agriculture, the digitalization, the precision phenotyping, and those sort of things. I think that can actually interest the youth and the learners maybe to come into agriculture and that you can also even use your smartphone for some applications in agriculture! [she laughs] I think that can also help. So we just need

to have maybe aggressive marketing starting in high schools and then when they join the universities, then we can also then try to interest them maybe to then pursue post-graduate degrees in agriculture.

**Hannah Senior:** And you've been involved with programs encouraging young people into agriculture and plant breeding before haven't you? Can you tell me about that?

**Julia Sibiya:** I was involved with a program that was funded by AGRA the Alliance for a Green Revolution in Africa. So we had a program called the Improved Master's in Cultivar Development for Africa, IMCDA across three African universities, Makerere University and Kwame Nkrumah University in Ghana and Iowa State University. So with this program, what we actually did was to introduce internships in our programs. So with the internships now, the students, after one year of coursework, the second year, when they are doing their research, then they would spend six to 12 months attached to a private seed company or attached to a national breeding program where they would learn everything that goes on at that institution.

**Julia Sibiya:** So this actually helped a lot of our students to see that, "Okay, when I finish, I have these options, I can actually do A, B, C, D." And a lot of them were also sort of absorbed by those companies that they worked for. It's a program, which I would want if I had funds to continue with where every student that comes actually has sort of an internship where they can see what is happening out there in industry. And then they can really appreciate that whatever they are doing, it's not like they're going to end up on the farm. But the interesting thing also is one of my students who was on this program, two of my students actually, they decided to go into farming, having learned what they learned from these companies, they decided to do their own thing. So it's also something that can give ideas of what you can do with your education.

**Hannah Senior:** That's a good point, isn't it? Because just because you study one thing doesn't mean you have to stay in that thing. It can give you new ideas that might take

you in a different direction or new opportunities that might take you in a different direction.

**Julia Sibiya:** Yes.

**Hannah Senior:** Okay. Moving on to some sort of general questions, what things are getting you excited at the moment? What things are interesting you at the moment?

**Julia Sibiya:** In 2019, I actually spent some time at Iowa State University for my sabbatical. And I then went into gene editing. I wanted to learn as much as I could to understand “What is this whole thing about gene editing?” So, yeah, so I did a project on gene editing when I was there. So it's something that has really, really interested me. And I'm working also on orphan crops or underutilized crops, most of which are indigenous crops. So they haven't received much research, but they are very valuable crops in terms of nutrition. And they have a lot of medicinal properties as well, and they can be used for many other different things. So for us to actually have sort of genetic gain or to commercialize these crops, we need to research on them and be able to bridge them much faster than we would have been just using conventional techniques. So I'm really thinking of applying some of these gene editing tools, also applying some of the modern breeding tools like the next generation sequencing tools, genotyping by sequencing, which allows you to genotype, at the same time, discover markers so that we can also use marker-assisted selection for these crops.

**Hannah Senior:** Could you give me an example of how gene editing might help develop an orphan crop and change its properties in a way that's beneficial? It might be helpful for listeners to sort of have a tangible example of that.

**Julia Sibiya:** There's one student who's working on a crop called miracle berry. It's a berry when you eat it changes your pallet so that when you eat something that's sour, it actually tastes sweet. This plant is found in West Africa, but it's very difficult to work with because it's sometimes very difficult to generate the seed. So we've geno-typed them.

And we are trying to discover if we can find markers, but with gene editing, I was just thinking like, if we could find whatever affects the seed, not to germinate immediately, maybe we switch off whatever it is then, maybe, we can improve and then we can have more plantations of that. And we have more of that berry being produced. It produces a protein called miraculin, which is like a natural sweetener that can also be used in various other industries.

**Julia Sibiya:** So that's one way we can apply gene editing. Then with discovering of markers, then we can also use markers for other crops to assist us in our selections. And instead of going through a lot of generations, selecting based on the phenotype, we can select based on the markers and that can also kick in the process. And we have products on the market much faster, and we can also produce hybrids for some of the crops as well and commercialize them.

**Hannah Senior:** Another sort of overarching question. What do you think has been the hardest part of your career so far? And why would you choose that part of your career as the hardest?

**Julia Sibiya:** [She laughs] I think the hardest part for me is been trying to balance work and family, especially if you have to compete in a male dominated field. At work you're expected to perform just like anyone else, irrespective of what other things, you have to take care of children and the like. So that has actually been the hardest part of my career, trying to balance and trying to remain competitive at work, but at the same time, not neglecting family, having time for family. I've traveled a lot because of the ACCI program that we had, which is a sandwich program. So we have to travel to different countries where our students are based and they're doing their research to see them. So you spend maybe a week or two weeks away, and maybe every month you travel to two, three different countries. So you have to put up with whatever is there. But it has been quite interesting as well, on the flip side. You get to see different countries, you

get to meet different people and yeah, but trying to balance that has been the hardest part of my career.

**Hannah Senior:** And then the last question, what opportunities do you see for the future?

**Julia Sibiya:** I actually do see a lot of opportunities like for myself instead of just working on food crops and the like, I'm seeing that I can also diversify. Recently I was approached again by someone who wanted me to work with them on breeding cannabis, which I thought, "Wow, that can actually be a very good opportunity!" Which can also help us to raise funds for research. And then we can use maybe those funds to research other crops because funding is also becoming a little bit difficult to come by. Then I also see more opportunities collaborating with the private sector, collaborating with the CGs, collaborating with other institutes in Africa, as well as overseas. I see a lot of opportunities and some of them have already started bearing fruit. Like I told you, I have this project with UC Davis. So through connections, with different associations, the NAPB, I've also made a lot of contacts that I'm starting to work with. So there are lots of opportunities, grasping these new technologies also might help us maybe to come up with products much faster on the market and maybe to get in more young people interested in plant breeding. Yeah, I think there are lot of opportunities in the future that we can take advantage of.

**Hannah Senior:** That feels like a good place to wrap things up. Thank you very much for your time today, Professor Julia Sibiya.

**Julia Sibiya:** Thank you, Hannah. It was really a pleasure.

[Theme tune plays]

**Hannah Senior:** You've been listening to plant breeding stories by PBS International, and I'm your host, Hannah Senior. Plant breeding is a pretty specialist podcast topic, which can make it difficult for people who share our interest in this kind of thing to find it.

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[Theme tune fades]