Transcript: Plant Breeding Stories Podcast
S3E4 - Jen Bromley at Vertical Future

[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: In this episode, I'm talking about the connection between plant breeding and vertical farming with Dr. Jen Bromley of Vertical Future. This type of growing in a totally controlled environment without even natural light has been a hot area among investors in recent years, indeed deal room estimates that $1.8 billion has been invested in this area since 2014. So we look at how the needs of this type of growing interact with the varieties under cultivation. We discuss what has been bred into and out of spinach for field cultivation and how the needs are different for vertical farming. And we explore what the future of plant breeding in other species for indoor growing might look like. Transcripts of this episode, and all our podcasts are available at pbsinternational.com/podcast. I hope you enjoy it.

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So Jen, a real pleasure to have you with us today. And as always, maybe we should start with telling me a little bit about yourself and about Vertical Future.

Jen Bromley: Hi Hannah. It's great to be with you today. So yeah, so as you said, I'm Jen Bromley, I'm head of plant research and development at Vertical Future. We're a

vertical farming technology development company. And basically what we do is we design and build vertical farms for clients, but we don't just design and build them. We also provide plant biology support and plant data that enables all of our clients to be able to produce the best produce that they can on their farms. Essentially, I'm a plant biologist by training and I'm a massive, massive plant nerd. So I'm living my best life at the moment.

Hannah Senior: We love plant nerds. That's fantastic. So a good place to start is have you always been a plant nerd? Or did that come later on?

Jen Bromley: It actually happened very early in my life. I can almost remember it to the moment when it happened. It was during my GCSEs, teaching us about how plants bend towards the sun and how you get differential elongation on the different sides of the cell and how that was caused by auxin. And at that point I was like right yes, plants, that's what I'm really interested in, that's for me. Every other part of biology, no. Hearts? Boring! Lungs? Boring! So general sort of human biology? Not interested! Which I think really disappointed my biology teacher because she was a biomedical scientist.

Hannah Senior: And did you have a botany background, a plant science background? Was there anything that sort of led you down that route or was it just that “aha!” moment?

Jen Bromley: I think it was definitely that “aha!” moment. I have a really embarrassing botany background in that I grew up in the center of Birmingham and my mum took me to the supermarket one day and on the way home, she was asking me where peas came from and I said Sainsbury's. [Hannah laughs] And she was like, no, no, no, but where do they come from before Sainsbury's? I was like, well, the factory where they put them in the packets, of course, but I hadn't quite grasped that they needed to be grown somewhere! [They both laugh.] So yeah, so I have a bit of a shameful botany background when it comes to it, but I think I've made good in the end.

Hannah Senior: We all have to start somewhere! [They both laugh] You studied natural sciences, is that right? And then specialized in plant science. So just tell me a little bit about that.

Jen Bromley: Yes, so I ended up applying to Cambridge University and I happily got into Cambridge University. So I studied for three very happy years at St. Catherine's College in Cambridge. And it was actually during my interview, they asked me, “What do you want to do? What are you thinking about doing as your final year specialism?” And I said, plant sciences and having since talked to the guys who interviewed me, they said they had a little chuckle about this afterwards because they felt that “she won't, she won't, she'll pick something else. She'll go with something else.” No one comes to that interview so set on what they want to do when there's such a massive breadth of science to explore in this course. But I really did stick to my guns. I almost got swayed at one point, but no, the green stuff was just way too interesting.

Hannah Senior: And then you went on to do a PhD. Was that also at Cambridge? And was that when you specialized in, was it plant breeding that you specialized in at that point?

Jen Bromley: I was specializing in potatoes at that point. So a lot of my work in my PhD, so yes, it was also at Cambridge and it was actually with the same supervisor who supervised my final year undergraduate project. And it was all based around plant hormones and how a plant responds to its environment and how you can essentially alter the hormones to be able to change how the plant responds. So it was focused on potatoes. So I'm a world expert of why your crisps might be a bit brown.

Hannah Senior: Very good.

Jen Bromley: Which is a strange thing to be a world expert in. But it's quite fun at the same time when it comes to sort of like meeting new people in pubs and stuff like that.

Hannah Senior: What was it you were doing in your PhD? What were you looking at?

Jen Bromley: The PhD was all focused on finding particular genes involved in potato tuber dormancy. And so looking at how potatoes responded and how you could get them to stay more dormant and also how you could break that dormancy. And so by finding the genetics involved, then that obviously gives you markers that you can breed for in the future. So you can rather than perform the years and years of experiments that I did watching potatoes, not do anything for days on end, months on end in fact. You can then screen the genetics of the leaf material before you even got a potato. So that actually, it saves the amount of time that you're looking at breeding for plants like potatoes enormously. So, that was kind of how I got into the sort of side of plant breeding that I'm in.

Hannah Senior: Right. And then after your PhD, you went on to work for British American Tobacco. Now that's, perhaps for some people that might seem like an unusual choice, because I think a lot of people think of tobacco and smoking, but there's more to it than that, isn't there? Can you tell me a little bit about that?

Jen Bromley: Between my PhD and working for BAT I did three post-docs and they all, at some point in them, we use tobacco. And tobacco is an amazing plant because it's so manipulatable, you can do so much with it. And we were using it to express proteins, to understand how those proteins interacted with one another. So then we could use those as breeding targets to be able to simplify our plant cell walls so that they're more de-constructable which allows you to get a biofuel of a plant a lot more easily. So the fact that you can express proteins in tobacco leaves, they're basically massive factories and they will express anything that you want them to. And so there's a really good example, actually, it's very pertinent to what's going on at the moment in our sort of global pandemic times. So GSK and Medicago, which is a plant expression company based in Canada have got a vaccine in phase three trials, which is produced in tobacco.

Hannah Senior: A COVID vaccine?

Jen Bromley: A COVID vaccine.

Hannah Senior: There is definitely more to it than just smoking. It's a fascinating plant.

Jen Bromley: It's really fascinating. And from the sort of the plant nerd perspective, tobacco's got an amazingly interesting biology. It's got really interesting metabolite profiles and very interesting genomics as well. And that's kind of what really led me to working in the tobacco industry.

Hannah Senior: And you did work on sequencing the tobacco genome. Do you want to just briefly expand on that for me as well?

Jen Bromley: Tobacco is quite a complex product. It's a tetraploid, which means that it's got two different genomes within it. It's a very young tetraploid as well, which means those genomes almost behave independently of one another. Last time I checked, we'd only really been able to see five crossing over events between the two parental genomes that are in tobacco. So pretty much behaved as amphidiploid, which is really quite an interesting plant and also made it an absolute nightmare to assemble at the same time.

Hannah Senior: So that must have taken quite a lot of effort and innovation to figure out how to solve that problem?

Jen Bromley: That was a big team behind it. I was part of a team within BAT, but we also collaborated with Lucas Muller's lab, Boyce Thompson Institute in Cornell. Between us, we basically did as much different types of sequencing as we possibly could. That was one quite fun thing about sequencing that genome was because it's complexity, we needed very long reads, but we also needed very short reads to help us to be able to differentiate between the two parental genomes. So we did pretty much every sequencing technology that was available at the time and then combined them and working on the order of which to combine them was really interesting. And in the end we got a genome that you could even read over the centromere.

Hannah Senior: Oh wow!

Jen Bromley: So yeah, it's pretty well complete.

Hannah Senior: It sounds like a phenomenal puzzle to have picked your way through.

Jen Bromley: Yeah, it really was. Yeah. We really had a great time doing it. It was very interesting and it really sort of allowed us to explore the biology of the plant much more readily and sort of the more I see people citing the publications that have come from it, the more I realize that it's really enabled lots of other people to do lots of work with it too.

Hannah Senior: So how did you get from there to Vertical Future? And how did you sort of, want to say step back slightly from the hardcore genetics and plant breeding to a broader plant science remit?

Jen Bromley: So I've always been into plant science because of the real positive effect that it can have on the population. And one of the key areas that plants can have an effect is through food. And so the opportunity to be able to work at a company whose ethos is to be able to produce the best quality, most nutritious food possible and make it available to the most broad population you can. It was a real turn on for me and something that I really couldn't say no to.

Hannah Senior: Your job title is director of plant research and development, and that's quite a broad title. So what does that encompass?

Jen Bromley: Well, it is a really broad specification of the job. So we go from anything, from looking at the nutrient profile of a plant - so we're looking at things like manganese content, potassium content, vitamin A, vitamin E - all the way through to can I take this plant that only grows in a very small area of the world but has a really high value for phytopharmaceutical production and can I make that grow inside? And can I get it to produce inside?

Hannah Senior: So you're looking at ways to apply the technology more broadly, the vertical farming technology more broadly as well as ways to make vertical farming of existing crops, more productive. Is that right?

Jen Bromley: Absolutely. Yes. So you've got the current traditional crops that vertical farming is sort of associated with, your sort of baby leaf, your lettuces, your herbs. And for that it's all about efficiencies and how you can get an improved yield over a year. And so whether you do that through having high yielding varieties and go through variety selection, or whether you're able to take one variety and make its growing time shorter, so you can get more cycles in across the year. But you've also got opportunities where you're looking at completely altering what you're using that crop for as well. So there's a lot of food crops as well, that can be used in sort of supplement production as well. So how do we take that food crop and the particular biochemistry that the supplement producers are looking for and how do we upregulate that through how we grow it.

Hannah Senior: Could you give an example? Maybe a specific of what kind of crop or what kind of output could be gained through doing that?

Jen Bromley: Yeah, of course. So, there's crops like broccoli, they're really good for you when you eat them, but the reason they're good for you is because they contain glucosinolates and glucosinolate related compounds and quite interestingly, a broccoli when it's in a micro green stage - so when it's maybe seven days old at the most - contains about 40 times higher levels of these particular chemicals than if you wait until you get a full head of broccoli. So you can get much more bang for your buck, taking the plant when it's in a lot smaller states and making the extract then, than if you wait until the plant is larger. Now, if you're growing them outside, growing to a larger size is easier for harvest. Whereas if you're growing them inside, you can get away with growing them for a lot shorter period of time and then harvesting them young because you don't have to deal with soil, essentially.

Hannah Senior: And I guess the economics are better because you've had to heat and light that space for a short period of time, as well?

Jen Bromley: Absolutely. That's one of the critical factors when you're considering whether a crop should be grown indoors, whether you should grow it on a vertical farm. Often people ask me, “Can I grow this?” And the answer is always, yes, yes, you can grow it. The question is, should you grow it? We could probably get trees to grow or grapevines, but you're not going to get any produce from them for at least maybe seven to 10 years. And that's a lot of energy that's gone in before you're looking at getting any sort of return from it. So you need to start looking at how can I make the cycles shorter or how can I make the harvested value higher? So yeah, so a micro green is a classic example of a high value crop. They have quite high worth when you're looking at the price per kilo, but also you can harvest them in between sort of seven and 20 days.

Hannah Senior: One of the things that we were talking about previously was the work that you're doing with spinach. Now tell me a bit about that. If I've got this right, it's not exactly breeding in the sense of developing new varieties, but it's more screening for suitability, is that correct?

Jen Bromley: Yes. So obviously there's a lot of work to be done when it comes to breeding, but given the range of germplasm that is available through the breeding efforts that people have done in the past. Then it seems silly to take a very narrow pool of genetics and try and select forward from that. When you can go back in history and you can look at what's available and start sort of doing your pre-screening now to select varieties that are available immediately, that are most appropriate to grow in a vertical farm. And then you can take that as your starting point for your breeding process. So we're collaborating with NIAB on this work. And one of the areas that we're looking at, it's not just about the crop yield and what it looks like. That is important, and that is data that we're collecting, but we're also looking at the genetics behind it as well. So we're

also looking at marker development because we're very aware that what we're doing now will influence the breeding activities of the future.

Hannah Senior: And why are you starting with spinach as opposed to any other baby leaf or leafy veg?

Jen Bromley: Spinach is a bit of a tough nut to crack for vertical farming. It's surprisingly low yielding in a vertical farm, and it has a tendency to bolt very early as well, so it goes to flower very quickly, which means that selecting the right varieties has always been quite tricky. Also, I mentioned earlier, it's important to look at how much you can get per kilo in terms of the price. Spinach is a very, very commoditized crop and it doesn't have a high retail value. However, it does have an incredible nutritional value. And the fact that a lot of it is imported into the UK means that there's a real sort of dependency on other countries producing it and shipping it to us.

Jen Bromley: And if COVID has taught us anything, it's that supply chain [she laughs] supply lines can go down when you're least expecting it, and you're at least ready for it. So by being able to grow things like spinach and working out how to get them to an economic viability is really important. And being able to do that on a vertical farm means we can control conditions all year round and we can make it perfect conditions for spinach. Whereas the trials that are going on at NIAB, the guys are having to stop the controlled environment conditions. So they're using glass houses. They're having to stop the growth in about June because it's just going to get too hot for spinach to grow.

[Theme music 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 well productive plants, right of food security, and more sustainable agriculture. Now back to the podcast.

[Theme music fades]

Hannah Senior: So how are you going about doing that work? How are you screening the range of varieties, the germplasm collection that you have for spinach?

Jen Bromley: So it's essentially with a lot of eyes on plants, I think is the best way of describing it. We're doing multiple trials under very standardized conditions that we've set up. And what we're looking at primarily are outputs like fresh weight and dry weight of the product, but we're also looking at things like the leaf intensity, like the leaf color intensity. So the intensity of the green that can give us a readout on the level of nitrogen, the level of nutrition that you can get from it. We're also actually going into the mineral nutrition content of them. So we've actually found spinach varieties that have about a hundred times difference in amounts of iron they accumulate. So it's quite impressive that we're seeing these differences. We hadn't expected to see something as dramatic as that, to be honest.

Hannah Senior: Just recap for me because I think the question that springs to mind for me, and no doubt for others is why would it be that the best performing varieties for outdoor growing or for growing in other circumstances would not also be the best performing varieties for indoor vertical farming environments?

Jen Bromley: So it might be that the cycle may be too long. If they perform well outdoors, they may just have a longer cycle. They also, it may get too high. Now when you're in a vertical farm, you're looking at maximizing your output in a volume, not just in an area. And so you have to consider where your lights are in comparison to where your crop canopy is. And so by having your crop canopy too close to your lights, you can potentially cause leaf burn through the heat from the lights and through sort of too much light.

Jen Bromley: But you can also make the most of the space basically through having a more squat variety that then produces more leaves. One thing that we've noticed

throughout our trials is the leaf physiology of spinach is massively variable depending on which variety that you're growing. We see leaves that are really big, but rolled. We see leaves that are that lovely sort of spoon shape that you'd expect of spinach. And then we see petioles that are really long, which makes the fresh weight a lot higher because petioles weigh a lot more than lamina, but you probably don't want to have that in your salad.

Hannah Senior: Right. Okay. And disease pressures should be much lower in indoor farming. So I guess that's something you don't need to select for in the same way as you would for outdoor growing.

Jen Bromley: No, absolutely. And that's one of the main rationale behind this project, is that throughout selection there's been a very sort of large pressure on disease resistance or disease tolerance. And that has been selected for over yield and sensory qualities as well. So the taste, the flavor and the amount of spinach that you're producing has been essentially selected against in favor of that plant, just not dying in the field. If something comes in, a mildew or another pathogen comes in, they could potentially wipe out a whole field. So as a farmer you're going to say, “I'd rather have the crop that is more likely to survive that and still produce something rather than the crop that I know I'll get a higher yield from, but I know I'm taking a bigger risk with, because if I do get a contamination or an outbreak that could be the end of the whole crop.”

Hannah Senior: Okay. That makes sense. And you just touched on the sort of sensory properties and the consumer preferences. So tell about how you assess that? We all individually have our preferences, but do you have a more systematic way of tapping into what the consumers want and expect?

Jen Bromley: Yeah, so we take a two pronged approach to sensory. So one is kind of harping back to how I like to approach sensory, which is using organoleptic and volatile analysis on a mass spectrometer. So very sort of a hardcore science, but what we also do and it's run by our head of food at Vertical Future. So Nico, he's a trained chef, and

he has what can be most described as the most incredible address book you've ever seen. So we've used his… [she chuckles]. I say “we've used his address book” - Nico has contacted a lot of his old colleagues and friends who work in the restaurant trade. So these guys are quite exceptional chefs and we've put together a sensory panel and that sensory panel then receives crops from us and we'll do testings and do tastings. We can then use that data to be able to start linking back to the genotypes that we’re also genotyping at the same time, to help us understand, can we link specific genetics or metabolites to specific flavor descriptors that are being used.

Jen Bromley: There's a very, very cool paper that came out in science. I think it was in 2016, basically doing this for tomatoes, where they got a lot of people to eat a lot of tomatoes and the result being, they found the genetics behind flavor in tomatoes. And then they were able to breed that into tomatoes and produce these trial varieties, which I have also managed to grow myself and can confirm are delicious. Essentially, I want to be able to replicate what they did in that incredible piece of work, to the sort of crops that we're growing and the leafy vegetables that we're working on at the moment.

Hannah Senior: We've talked about screening, existing varieties and different means of assessment and how the properties that you need for growing a crop indoor farming, as opposed to outdoor are different. I'm curious about what you think the role will be, what the future looks like for breeding for totally controlled environment agriculture of this type?

Jen Bromley: So there's, I think there's a real sort of opportunity for breeding and you can see that there's an opportunity for breeding by the investments that people are making. So you see the partnership companies that have started to form. So you've got Unfold, which Bayer are involved in, which are specifically breeding for indoor agriculture. You could see some of the opportunities from the advancements that have been made for traditional agriculture. So one of the critical factors that I've already mentioned is the height of the plant. So the fact that we were able to dwarf a lot of our grain crops using dwarfing related genes, or actually knocking out dwarfing related

genes. That sort of thing can be done quite readily for an indoor environment as well. So you could start looking at producing crops that would normally be a very tall crop. You can maybe drop down and have a smaller crop. So I think that will be quite important for things that are fruiting, like fruit related crops as well.

Hannah Senior: So over time, we should start to see a broader range of crops being feasible or economic, for indoor growing of this type?

Jen Bromley: Yeah, absolutely. And there was a really interesting paper that came out the last week and that was all related to the circadian oscillators and how the importance of photoperiod and circadian rhythms has really sort of influenced agriculture. And so we may not have realized at the time that we were selecting for these genes that are related to the circadian oscillator. But when you look at a lot of the varieties that we grow traditionally, these have all been selected because of that sort of early flowering, which is regulated by the circadian oscillator. So there's huge amounts of opportunity that we can look at in that space as well.

Hannah Senior: Fascinating stuff. The last year with the pandemic has been difficult for all companies and all organizations, but especially for startups and young companies like Vertical Future. So tell me about how that has been for you and how has that changed the kind of things that you've been working on?

Jen Bromley: Well, initially it was very strange because suddenly having to work from home as a plant biologist became quite tricky. And I actually ended up setting up a little growth room in my loft space [she laughs] which allowed me to carry out sort of two, sort of gravel trays worth of experiments at the same time. Essentially using growth lights that I picked up from work and then set up some crop trials. It allowed me to start asking questions of… Under my sort of home boiler, totally controlled environment, which was not that controlled, but still with the lights and things like that. Like how long is it going to take me to get to flowering with particular plant? How long is it going to take me to get to a certain number of leaves? So it was possible to start doing some

experiments at home. They were pretty rudimentary and they did need repeating as soon as we got back into site.

Jen Bromley: But yeah, that kind of activity was, it was about thinking outside the box and working differently. And how could you make the best of the situation that you were in. Interestingly, at Vertical Future we've actually grown during the pandemic. We've been able to employ new staff, we've developed our technologies further and we've been selling and commercializing our technology during this period. So although it sounds crazy, we've actually had quite a successful year, even though the pandemic has really sort of slowed things down a bit, but it's also allowed us space to think as well as space to sort of really look at our technologies and think, okay, how can we do this better? What should we change here? It almost allowed us a little bit of breathing space to allow us to think a bit more.

Hannah Senior: Being mid-career. What are you most proud of so far? And what things are you most excited about for the future either in technology or in things that you'd like to think about getting involved in?

Jen Bromley: Oh gosh. Okay. So I think the thing I'm most proud of, this is going to sound really strange. I think it's my first, first author paper when I was working in glycol biology. I think that paper really sort of changed the way how a lot of people were thinking about that area of science and what it also did was spur on some quite incredible research and quite incredible adaptations of NMR to be able to study solid state sugars. So looking at the plant cell wall without having to chemically break it down, which is how you'd normally do it. They were able to use a solid state NMR approach to be able to look at sugars in relation to one another.

Jen Bromley: So how do all these carbohydrates sit within the cell wall? And how do they relate to lignin? And so on. Although my paper, the work I did, didn't do that. It kind of proposed a hypothesis that we thought would be viable and likely based on the data that we had. And then that then spurred on all that work. And that was really exciting.

And it's been really, really enjoyable to see that area of science grow, even though I don't work in it anymore.

Hannah Senior: And by NMR, do you mean nuclear magnetic resonance?

Jen Bromley: Yes.

Hannah Senior: I'm not super familiar with NMR. Can you tell me more about that?

Jen Bromley: I'll be honest. I'm not super familiar with it either. It's not a technique that I used, but it's a technique that was applied essentially to prove the hypothesis that we put forward was right. And that was just really exciting to see that somebody had done something so different and sort of thinking outside the box to be able to work on that and brought together a collaboration of multiple different institutes as well. So yeah, it was great. And it brought people into the cell wall field who were NMR specialists who would normally not be looking at plants at all. So that was quite exciting as well. Bring more people to the green stuff.

Hannah Senior: Bring them over to the green side. [They laugh] And then looking to the future, what things do you think are most exciting for the future. Or where do you see the greatest opportunities?

Jen Bromley: Oh, that's tough. I think the future is, there's always something new to find out. There's always something to learn. I am most excited by just progressing knowledge. I told you earlier, I'm a massive plant nerd and anything that's new that you learn about plants is really exciting. But I think within sort of the sphere that I'm working at the moment, the vertical farming sphere really, there's so much potential, so many opportunities. And I think the fact that with the technology improvements that have been made within the sector, and now also considering these ideas around what varieties you should grow, how are you going to start approaching breeding programs that are going to fit for the controlled environment agriculture sphere?

Jen Bromley: There's a real opportunity to be able to make the produce that comes from a CEA environment, much more available to the general population. Because at the moment, a lot of the produce that comes from a vertical farm, it's quite high end because of the cost involved in producing it. But as the technology improves and as the varieties improve, you're going to bring those costs down and there's going to be a real step change. So people will be able to access much more locally grown, much more sort of recently harvested, much more nutritious food year round, and not relying on things being trucked across the world or flown in on planes and from here, there and everywhere.

Hannah Senior: Are there any inferences you're particularly grateful for so far?

Jen Bromley: Oh gosh. It's probably my PhD supervisor. He taught me how to write. I think it was a really important thing.

Hannah Senior: Oh God. Tell me about that.

Jen Bromley: He absolutely ripped apart my first piece of writing that I did for him.

Hannah Senior: Ah!

Jen Bromley: And then as time progressed, it got to the point where there would be minimal red pen on it. And at that point I felt sort of, I'd learned a lot from him, so yeah, that was David Hanky. I first encountered him when he was lecturing me as an undergraduate and he was just so enthralling and so interesting and he just made plants sound so cool. If I can take even part of his enthusiasm forward and inspire the next generation then that's something that really sort of sits with me. His sort of passion for passing on the knowledge and passing on the enthusiasm.

Jen Bromley: But then I've also, I suppose, during my PhD, I was exposed to some work from the Max Planck Institute of molecular plant physiology in Pottstown. And particularly work by the lab of Lothar Willmitzer and his work's really been a big

influence on how I've thought about plants, because a lot of that's on metabolomics. And how you think about the biochemistry. How you look at the plant, in terms of what it does, when it's doing it and how that impacts on our perception of it. And so, yeah, so I first came across his work in the potato sphere many, many years ago, but then I've actually been lucky enough since to be able to actually work with him. And he's just such a nice person as well. So it's so amazing when you meet kind of your scientific idols and you realize actually they're just really nice as well. They haven't sort of lived up to the hype that you've given them. They're just a nice person, who are actually very good at science.

Hannah Senior: So what's next for you and what's next for Vertical Future?

Jen Bromley: Oh, Gosh. So next for Vertical Future. So we're looking at rolling out more of our technology, more clients and getting more vertical farms set up around the UK, but also around Europe and the world. So we've got projects that are going international this year, which is quite exciting. So that's a big, big thing for a startup, I think. And for me it's difficult to say, I'm having the time of my life. I'm not sure what I'd want to change what I'm doing at the moment! So it's just, finding out new things, just keep learning and keep inspiring my team, keep being inspired by my team as well. I learn a lot from them as well as I hope that they learned something from me. And then keep on teaching as well. I still teach. I'm lucky enough to be a supervisor at the University of Cambridge. So I get to pass on my enthusiasm for plants to first year plant biologists in the natural sciences Tripos.

Hannah Senior: Fantastic. It has been a real pleasure to talk here today. Thank you very much for your time, Dr. Jen Bromley.

Jen Bromley: Thanks Hannah.

[Theme music 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. So if you've enjoyed the podcast, recommend it to your friends and colleagues and please help others in the plant science community to find it by rating this episode and subscribing to the series. I'd love to hear from you if you want to suggest people you'd like me to interview, you can contact me on Twitter @PBSint or on Instagram at @PBS_int. Until next time stay well.

[Theme music fades]