

Transcript: Plant Breeding Stories Podcast
S4 E1 Chal Landgren, Christmas Tree Specialist



[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.

It's been a long wait for series four, and I'm pleased to tell you it is coming soon. In early 2022, we'll have the final series of this podcast and some excellent stories to share with you. We have listeners in about 60 odd countries, so not all of our listeners will be celebrating Christmas, but most will be aware that it's happening. This episode is a special seasonal edition to kick it all off. And I hope you enjoy a little behind the scenes look at what it takes to produce that iconic festive decoration, the Christmas tree.

Transcripts of this episode, and all our podcasts are available at pbsinternational.com/podcast. I hope you enjoy it.

[Theme music fades]

Hannah Senior: Welcome to Plant Breeding Stories, Professor Chal Landgren. This is a seasonally themed episode, and I'm delighted to have you with us today. Would you like to start by telling us about your role?

Chal Landgren: My position at Oregon State University is Extension Christmas Tree Specialist. So my role is research and extension projects that relate to Christmas trees. And those tend to be genetics, tree identification and breeding cultural practices revolving around shearing, and top work and planting trees. And most recently we've been doing some work on trying to get trees to survive on our dry summers, with heat domes and no rain, and hot days all through the summer. So that's been a focus of research in the last three years.

Hannah Senior: Because a Christmas tree is not just for Christmas. We need it healthy all year round!

[Hannah laugh's]

Chal Landgren: Yeah, most people wonder what I do after December. You know, if I just start watching television or go into hibernation and then wake up in 10 months. It's a year round position. There's a few states in the US that have similar positions. Oregon happens to be the state in the US that has the largest Christmas tree harvest, but there are people in North Carolina, Michigan, and Washington state, and Pennsylvania that do Christmas tree work as well.

Hannah Senior: I have lots and lots of questions about Christmas trees. So we'll get into that in a moment, but I would like to know how did you come to be in this role? So maybe could you start the story right back at the beginning with how did you get interested in plants? Did you grow up in a rural area, or was there somebody influential? Just tell me a bit about how did you even get turned towards plants in the first place?

Chal Landgren: No, I grew up in suburban San Francisco and the East Bay. And I think one of my... And I had no interest in plants. So I think the first inkling that there was something exciting there was probably just working with the Scouts, and going outdoors and doing a lot of hiking and that kind of stuff. So outdoors was interesting, and then we would pick up a Christmas tree as a family from UC Berkeley, they had a genetics

breeding test up in the Oakland Hills, and we'd go up there. And I was fascinated by the difference between the plants, and they were selling sequoias for Christmas trees. And there was tremendous differences between families, so I got interested there.

Hannah Senior: You mentioned UC Berkeley had a genetics and breeding program. Was that specifically for Christmas trees? Because I hadn't really thought about Christmas tree breeding, but it sounds like you had. You were at least aware of that concept of doing plant breeding for Christmas trees fairly early on.

Chal Landgren: I don't think it was specific for Christmas trees, but my assumption was that it was something that they had. And they realized they could make some money by selling Christmas trees to the public, and getting the genetic information that they needed early. They actually did have, though, a particular clone that they were propagating. It had a special characteristics for Christmas trees, so they actually did sell that as a clone for growing Christmas trees.

Hannah Senior: So were they like thinning, and selling the ones that they were thinning?

Chal Landgren: Yes.

Hannah Senior: Okay.

[They laugh]

Chal Landgren: Yeah. I think that was exactly what they were doing and making a little money for probably the forestry club or something like that.

Hannah Senior: That's very enterprising, I rather respect that. [They laugh] And circling back from that clarification, what did you go on to study and where?

Chal Landgren: I did my undergraduate work at UC Davis, and probably the only subjects that I was kind of drawn to was botany and plant studies. So then I got

interested in forestry when we had... Visiting professors came up and gave some talks at UC Davis, and I transferred to Berkeley and forestry. And worked most of my initial career as a forester, kind of working with small woodland owners. And then my wife went back to graduate school, and I was bored and needing something to do. So we bought seven acres of property, and wondering what we could do with it. And Christmas trees was the best solution we came up with. So in 1981, we planted seven acres of Christmas trees, and I've been interested in Christmas trees ever since that initial planting.

Hannah Senior: Oh, right. So that's 40 years in the Christmas tree market now, so it's fair to say you're an expert. Can you give me a bit of an overview of that market? How many trees are harvested and where are they sold, and so on.

Chal Landgren: The Oregon market, we harvest about three and a half million trees a year. And our biggest market is California, but trees go into all of the Southwest states and really across the country. Our biggest export market is into Mexico, but we also are shipping trees into most of the Far East in refrigerated ships and containers, and airplanes. We've been as large as six million trees a year in harvest in Oregon. The national market is a little bit vague to describe how many trees are sold every year. It's probably somewhere around 27 million. And Oregon, North Carolina, Michigan, Pennsylvania and Washington State are the main contributors to that national market. But every state has probably some level of Christmas tree growing somewhere in it. So that's a rough overview of the market.

Hannah Senior: To get a sense of the scale, how many Christmas trees can be grown on an acre of land.

Chal Landgren: There's about 1400 trees per acre.

Hannah Senior: So that would be well over 19,000 acres of Christmas tree plantations across the US alone.

Chal Landgren: That sounds good. And that's, if an entire acre gets harvested, which is fairly rare. It takes usually about three years to harvest an acre or a hectare, whatever land measurement we're using. The harvest cycle's about three years in length for any given piece of ground.

Hannah Senior: Three years, and does that mean the trees are three years old? Or they've been in the ground and they were a few years old before they go into the ground?

Chal Landgren: The trees when they start are usually about two years old, we'll plant a two year old seedling. And then at least for Noble fir, the cycle is about eight years. We'll probably get our first tree harvest on a given acre at year seven. And that'll be the ones, the trees that are the fastest growing and the best looking. And then the main harvest will be in year eight. And then we'll kind of clean up that field in year nine. It'll vary by sight and species of grower, but that's kind of the general rule for Noble fir.

Douglas fir grows a lot faster, and it's our second most common species that we grow in Oregon anyway. And it'll have about a five year harvest cycle. It's less valuable per foot when growers come to sell it, but you can almost get two rotations of Douglas fir in the time it takes you to do one rotation of Noble fir. But noble firs, probably 60% of our current market. It may change as we look at heat damage and summer droughts, and things like that. But that's kind of currently... Noble fir is our is 60% of our market. Douglas fir, probably 30, and then 10% is divided between Nordmann, Turkish, and Grand fir and a couple other minor species.

Hannah Senior: So if I were to ask a very generic question, this might be different by species. What makes a good Christmas tree? Like what are you looking for when you're saying either this is going to be a good species or this specimen is a good specimen.

Chal Landgren: In some way, that's a loaded question. That's like asking somebody what's a good looking spouse look like? [They laugh] But the things that we look for in

terms of breeding, and growers are interested in, would be reasonably fast growth. We look for upright branching, and that helps to control the density of the tree, or improve the density of the tree. We look for a good colour, and we look for disease and insect resistance. And those are kind of the main characteristics that we're looking for. So our typical progeny test is we would do an evaluation based on height. Then we would look to see how many holes are in the tree. In terms of holes that would be bigger than say a big softball. If there's one hole in a tree that would be okay, if there's two on different sides, that would be a different grade.

And if the colour's poor, that would be a downgrade. So we have, generally, four different categories for grading trees. We have premium trees, which are very rare on a given acre, a number one. And then number two, some growers have a grade that would be a utility, which would mean if the price was cheap enough, you wouldn't mind having it in your house. But it's not as pretty as some of the other ones. And then there'd be a cull. That would be one you just wouldn't want your next door neighbor to have in their home.

Hannah Senior: When you talk about having a hole in them, I kind of get the idea that when you look at your Christmas tree, you don't want it to be lopsided or to be nice and bushy at the bottom and thin at the top, that kind of thing. But I can see that some of those traits would be genetically determined. But in my head, I was thinking that if it had a hole like that, that would just be a consequence of, I don't know, damage or insect activity or something like that. Is it genetic?

Chal Landgren: Certainly there's a genetic component to that. Having those open gaps in a tree, they're just probably aren't sufficient branches and buds to cover the tree in those areas. Having run a U-Cut lot at our own farm, there are certainly people that come out to the farm and say, I want trees with holes in it, because I can put in a big ornament or something. So certainly beauty is so much in the eye of the beholder, but in terms of grading trees, the density is something that growers are trying to make uniform

from the base of the tree to the top. And that's reasonably hard to do with trees that grow slowly at first. So that means their bottom branches are going to be very bushy and full, and then it starts to grow excessively long as it matures.

So after the tree gets to be about a meter and a half, or five feet, the tree starts to grow fast. So the strategy that growers are using is try to control the height growth after the tree reaches say a meter, meter and a half. And try to even out that density of the tree, by both shearing the sides of a tree and controlling the height growth. So that demands that there's enough inter nodal branches, that it has the ability to fill. If there's not enough inter nodal branches and buds, those gaps will form all over the tree and, and be poorly kind of configured.

Hannah Senior: And while we're talking about the basics of the Christmas tree market, can you tell me about how they're harvested? Because when we spoke previously, you told me something surprising about that.

Chal Landgren: Some of the larger growers in Oregon are using helicopters and that's done in probably two different ways. Probably the most common way growers are doing their helicopter harvesting is they'll have piles spread out through their fields of maybe 20 to 30 trees. And those piles will be wrapped with a polyester rope sling. Then there'll be a person on the ground, and obviously someone in the helicopter, and the helicopter will come and drop a line down to this hooker, say, on the ground and they'll hook that pile up. And they'll probably be two or sometimes three of these guys on the ground, hooking the piles up to the helicopter. The helicopter will drop the piles sometimes into an area where they're starting to wrap the trees with string, which is called bailing, or they'll drop the trees directly into specially designed trucks. That they'll then take the trucks to a central spot where the trees will be bailed and wrapped and get ready for harvest.

Hannah Senior: It seems like a very elaborate process to use helicopters. Is that because these are fairly remote sites often?

Chal Landgren: Yeah. They're remote sites, and what it does for the growers is it means they don't have to have as many roads, and roads are very expensive operations. And there tend to be fairly hilly sites, although not always, but it means that a lot of the operation for other things like spraying and fertilizing, et cetera, will be also done by helicopters, rather than having a lot of roads. These trees can be heavy, a big Noble fir can weigh 70 pounds or 30 kilos. So it takes a lot of effort to move these things. So if you can get a mechanical assist with a helicopter and labor is getting more scarce all the time. And it tends to be the larger growers that will have access to helicopter companies, to contract with them for a long period of time.

On our little farms, it's pretty much hiring people to haul the trees to a central spot. Then the grower will bring in a baler, and then bale the trees up so that they're compressed. And then take those with a trailer to a central loading spot, and then load trucks. And most of the trucks are loaded with individual trees on an elevator, going up and putting into the cargo van. To load say 500 trees in a truck, it may take seven people two hours. So it's a very labor intensive operation, and then they have to be unloaded at the distribution point at wherever the customers are.

Hannah Senior: Like so many things in life, it seems like one of those things where if you don't think too hard about where it came from, you would never realize how much time and effort has gone into it.

Chal Landgren: Yes. Yeah, and I know a little bit about Christmas trees and ignorant about a lot of things. But I appreciate how much time it takes on trees.

[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 story 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 music fades]

Hannah Senior: So let's move on to breeding and seed production, so that's obviously a big piece of the work that you do. Can you give me a bit of an overview of the program that you're running?

Chal Landgren: Yes. We have a variety of seed orchards that we've put in over the last 20 years, but the program kind of starts with progeny testing. So we'll have either customers or clients that we'll do seed collections, and oftentimes we'll go out with some of those people and help identify trees that are of interest in the wild. And that's easy with Douglas fir and Noble fir, because they're naturally occurring species in Oregon and Washington. So we'll identify trees in the wild that have the characteristics that we're looking for. Those upright branching, lots of inter nodal branching, good form, good shape. The way we've typically done our progeny testing, is to identify four or five growers in Oregon and Washington. And we'll spread out the progeny tests from Southern Oregon up through Washington. And the trees will be the property of the growers, and they'll treat them just like any other tree on their farm.

And then we'll evaluate the progeny maybe in year four, and then we'll evaluate it just before the year of harvest. And we'll identify those individuals that have the characteristics we're looking for. And then if we have the opportunity, we will go back and take cuttings from the parent tree in the wild. If that tree doesn't exist anymore, we'll take cuttings from the progeny. Those will be grafted into seed orchards, and then we'll be kind of working on the seed orchard to produce seed for future Christmas trees. And

we've got five different seed orchards for Noble fir. We have two seed orchards now for Douglas fir, and then we're working on a seed orchard for species that aren't native to Oregon or even to the US. So we're looking at Nordmann fir, and Turkish fir, and Trojan fir as being species that we have interest in for future breeding.

Hannah Senior: And what traits are you prioritizing in your program?

Chal Landgren: All these different traits have different levels of heritability. And of the traits that we're looking for, probably the most trait would be bud break timing. So we would be looking for trees that don't break bud too early in the season, because they would be hit by frost. Height is a little less heritable, but it's certainly a trait that we're very interested in. The traits of disease resistance and pest resistance tend to be much more general. So they might be associated with that species rather than that individual family. Then color tends to be fairly heritable, so that's one that we can identify, and have done breeding for.

Hannah Senior: And once you are finished inspecting and selecting your progeny, and you know it's one you want to run with, it goes into seed production. Is that right?

Chal Landgren: It depends a little bit on the species and the grower. So there's still a lot of seed that is collected out of the wild, particularly with Noble and Douglas fir. More so with Noble, there are still wild collections of seed, but more and more where seed is being produced in seed orchards. Then with some of the unique species, the Nordmann and the Turkish and the Trojan fir, we're getting more and more seed production domestically, but still the bulk of the production is imported from Georgia or Turkey. Or from Denmark, because Denmark's done a lot of Christmas tree breeding, and they have seed stands of Nordmann and Turkish for in Denmark. Even though it's not a native species to Denmark or to the US, but they've been doing enough breeding work for long enough that they have seed orchards that are where we get a lot of the Oregon seed from.

Hannah Senior: So when you find a family, or you find a particular plant that you like, you then graft that onto root stock to create the seed orchard and then the seeds have produced open pollinated. So you can have in effect clones in the seed orchard, have I understood that correctly?

Chal Landgren: Yeah, they'd be grafts from the progeny in the test, because we can't go back to Georgia to get the parent tree. And then those are clones in the orchard, and most of our orchards are open pollinated. So they'd be from the nearest neighbor that happened to have Paul and Baldo. We have one orchard where they're actually are doing pollen bags and controlled pollination.

Hannah Senior: My favorite kind of seed production, of course.

[They Laugh]

Chal Landgren: That would make you very happy, yes. But mostly open pollinated.

Hannah Senior: And my understanding is that the volumes of seed produced can vary quite a lot from year to year. How has that managed?

Chal Landgren: I don't know if we manage it or we just accept it, especially for Noble fir. So Noble fir doesn't seem to have a good seed crop, but every five years or so. And it's still sort of magical and mysterious about those conditions may be to encourage Noble fir to produce cones. The operating kind of hypothesis is that things that stress the tree often cause them to produce seed and produce cones. So this next year might be a good seed year, because we had such a horrendous drought this last year. We had a horrible seed year last year for Noble fir. We've done experiments where we've done injections with gibberellic acid, and girdling for Noble fir, but it's less predictable on Noble fir than it is with Douglas fir. The flowering process for all of these conifers is a two year process. Nordmann, Turkish, and Trojan fir we're learning about, but it appears

that it's much more frequent flowering and cone production than certainly with Noble fir. Why? I don't know.

Hannah Senior: But you can store the seed can't you? So you don't get caught out with "Oh we can't plant any Douglas fir this year, because we had a dreadful harvest." Is that right?

Chal Landgren: Yeah, you're exactly right. So Douglas fir and Noble fir store really well for a long period of time. We have a seed that's a decade old that we're still using, and it still has high viability in germination. Nordmann, Turkish, and Trojan is a little more perishable. Many of the nurseries won't buy seed that's more than two years old. So it's fortuitous that it's... The species tend to be more regular producers of seed and flowering, because we just haven't figured out the strategy to store it for long periods of time. We're working on strategies of looking at different moisture contents to store it, and different temperatures to store the seed at. But haven't found that magic long term storage solution yet.

Hannah Senior: I want to go back to something you mentioned briefly, which is your trip to find new genetics. I, in my naivety, assumed that Christmas trees came from somewhere like Scandinavia, but you actually went to Turkey. Tell me about that.

Chal Landgren: A group of us got very interested in doing more specific collections of Nordmann and Turkish fir in 2010. And so we went to Turkey, and we were looking at Turkish fir and Trojan fir. We were interested because we've known for a number of years that Nordman and Turkish fir tend to be resistant to most of our native root rot problems. And they tend to do well in fields that are poorly drained, which is common in Oregon. So we organized a collection trip where we went to three different areas where Turkish fir is grown, and we went two areas where Trojan fir is grown. And the process that we used was to pick a road or a tract that we could follow from the lowest elevation

where the species grew, to the highest elevation where the road either petered out, or the species didn't grow any longer.

So we collected trees at about every half a mile, or a kilometer along the road. A couple of us would go out ahead of the cone pickers, and we hired brave Turkish guys that climb trees and pick cones way up in the tops of these tall, tall trees in the forest. And we'd identify the trees again that we thought looked like great candidates. The first criteria was that it had cones, and the second one would be that it looked like it was a promising Christmas tree with lots of branches. The climbers didn't like the trees we picked because they had so many branches that they were hard to climb.

They would pick the cones, we'd GPS each of the locations of each of the trees. We made measurements on the length of the needles, the shapes of the needles, the length of the cones, the color of the foliage and collected DNA from each of the trees. Then the cones were processed in Turkey and shipped over here, so the seedlings were grown. The seed from the trees that we collected in Turkey were grown at a nursery down in Springfield, Oregon. And we planted progeny tests across the United States. We've already made selections that are being grafted into seed orchards. This year, the trees are being harvested as Christmas trees. It's taken a while for them to develop, but there's some just really outstanding families of Christmas trees that we're looking at.

Hannah Senior: What was the main driver for this expedition? What were you looking for?

Chal Landgren: One of the emphasis for doing the collections was that these species are Mediterranean. They're adapted to dry summers, and they tend to be very slow growing in their first few years, and they're growing deep roots. During these drier summers, we've had much better survival with Douglas fir, and Nordmann fir and Turkish fir and Trojan fir.

Hannah Senior: I know you've already mentioned heat domes and drought. How is climate change affecting the Christmas tree industry?

Chal Landgren: This year in Oregon, and I hope you avoided it in Great Britain, we had what we're commonly calling a heat dome. We had temperatures that reached 119 degrees Fahrenheit.

Hannah Senior: Oof, Almost 50 degrees Celsius.

Chal Landgren: It's very hot. We had never experienced temperatures even remotely approaching those. And three days of that temperature, the trees essentially had heat stroke. The response of the tree is to basically make itself smaller. So they'll die from the top down and from the outside in. And then on top of that, we had a very dry summer.

We typically have very Mediterranean summers in Oregon, even though we get a lot of rain in the winter. Often from June to late September, we won't get any rain. Combine that with three days of ungodly hot temperatures. We had a lot of mortality this year, and of the species that we commonly grow, the Noble fir seedlings were the most sensitive to those two events, the heat dome and the long hot dry summer. So we lost, I'm estimating, 70% of the seedlings that were planted this year of Noble fir. So in eight years, we're going to see a shortage of Noble fir. Because nurseries are, with the fires we've had in Oregon, in Washington and the demand for seedlings. You just can't go out and buy another million seedlings. So we're going to see in a few years, some drops in supply.

Hannah Senior: Gosh, well we heard it here first. So what's next for you?

Chal Landgren: Well I'm actually half retired. So my goal in life would be to find somebody that would be a replacement in the position, that will take on a lot of the breeding work, and a lot of the research efforts that we've been working on for 20, 30

years. So that's my hope. Our Christmas tree growers tend to be optimists, and so they're always hoping next year will be better. But like a lot of farming across the world, a lot of the growers are getting older, so we'll hope to get some younger family members interested, and others.

Hannah Senior: So any young plant breeders who are listening who think, Hey, I might be interested in Christmas tree breeding. They should maybe make contact, hey?

Chal Landgren: That would be great. We can get my bosses interested in filling the position, and then we'll have people ready to go.

Hannah Senior: Are there any influences you are particularly grateful for as you've been through your career?

Chal Landgren: Yeah. I've had many mentors that have helped me along the way. Barney Douglas, Ken Brown and people that came into the position before me largely doing tree breeding, actually. Growers that in the case of Barney Douglas, he was very interested in breeding Christmas trees, and setting up seed orchards. And he was a grower, but he also had a passion for breeding blackberries. And so he developed a thornless Blackberry that has gone on to some more fame than some of his Christmas tree work. It's interesting the way interests take people.

Hannah Senior: And last but not least, very important question, what species of Christmas tree will you have, if any, this year? Tell me about your Christmas tree choices.

Chal Landgren: If we weren't going up to the mountains, we would have a Turkish fir from our farm, but in fact we're going to be up at our mountain cabin. And so we are going to cut down probably the top of a tree because it's already snowing and it'll probably be a Silver fir.

Hannah Senior: And that's because that's available, or because that's an active preference or a bit of both?

Chal Landgren: A little bit of both, but the limiting factor is it's a mile and a half of skiing into the cabin. So we're going to not haul a tree in there. We're going to try to find one close by that we can cut down.

Hannah Senior: [Hannah laughs] So that 70 pound tree that you were talking about, not an option?

Chal Landgren: Not going to be, not going to happen this year. That's for sure.

Hannah Senior: Good. Well, thank you very much for your time. It's been such a pleasure, such an interesting subject and I wish you a very Merry Christmas.

Chal Landgren: Oh, you too. And this has been fun.

[Theme music plays]

Hannah Senior: You've been listening to a special seasonal edition of Plant Breeding Stories by PBS International, and I'm your host Hannah Senior. Season four will be coming to your podcast playlists in the new year. And in the meantime, have a very Merry Christmas and a happy holidays.

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[Theme music fades]