Free the Seed!
Transcript for S1E1: Goldini Zucchini

Rachel Hultengren: Hello and welcome to Free the Seed! This podcast is for anyone interested in the plants we eat – farmers, gardeners, and food-curious folks – who want to dig deeper into the story of where their food comes from. It's about how new crop varieties make it into your seed catalogues, and onto your tables. I'm your host, Rachel Hultengren. On this podcast, we'll hear from plant breeders the stories of how they developed new cultivars that fit the specific needs of farmers and eaters, and why they pledged those varieties to the Open Source Seed Initiative.

In this episode we'll talk with Dr. Carol Deppe about her OSSI-pledged variety 'Goldini Zucchini'. Oregon plant breeder Carol Deppe holds a PhD in Genetics from Harvard University, and focuses on developing superbly flavorful, organic-adapted, open-source crops for human survival for the next thousand years, and in teaching others to do the same.

Rachel Hultengren: Hi Dr. Deppe, welcome to the show, and thanks so much for being with us today!

Carol Deppe: We'll have fun, I'm sure.

Rachel Hultengren: I'm looking forward to it. So today we're going to be talking about your OSSI-pledged variety 'Goldini Zucchini'. And maybe we can start by telling me a bit about the variety – what do you highlight in the catalogue description?

Carol Deppe: Well, this variety is unusual in a lot of ways. For one, I bred it not just as a really delicious summer squash, but it's also great as a drying squash, and I'll talk a little more about what I mean by that. But that means that you can produce a long-storing winter staple from your summer squash patch as well as a summer squash. And for reasons completely non-obvious to me, it also turned out to have spectacular flavor raw. That's really unusual, because when people say that some squash is good raw, I figure that, you know, it's edible raw. That's not the same as being good raw.

Basically, the variety got its start when I was reading a book called *Buffalo Bird Woman's Garden*. And this was about the agriculture of the Hidatsa Indians in the Upper Midwest. And from this book, I learned that the main way that the Indians ate squash - other than just eating it as summer squash - but their main long storing staple was not the mature fruit, it was dried slices of squash that were harvested at the summer squash stage. That was big news to me, but as I thought about it it made a lot of sense, because the Indians didn't have good storage space or conditions to store a whole lot of dried squash some place. But they did have good storage conditions for stuff that was completely dry, like dried fruits and vegetables, and dried meat, for example. But at any rate, I thought, 'Well, this is neat.' And the book described exactly how to make the slices, and how thick they should be, and this whole process of how the Indians did it. They had special knives; they had special racks and strings and trays, and drying platforms and so forth.

But just for starters, I said 'Well, let me just find out whether I like dried squash.'

Rachel Hultengren: Right.

Carol Deppe: So for that, all I needed for that was the same dehydrator that I dry seeds in. And I could just slice the slices however thick I wanted them, and dry them. And it turns out that actually most summer squash, the flavor is pretty much… it doesn't have any. Some of them actually taste bad, but most of them don't taste like anything at all.

So it was just a matter of finding a variety that would taste good when it was fixed this way. I tried a couple dozen different varieties, and I found that the yellow zucchinis really had a very nice flavor when they were dried this way. Another squash that had a very nice flavor when dried but a completely different flavor was Costata Romanesco.

Rachel Hultengren: And what does that look like?

Carol Deppe: That is a big green zucchini with ribs on it. And just about any of the golden zucchini tasted great dry, and had pretty much similar flavor. But I found that there were a whole lot of other things that helped a whole lot in making dried squash.

My basic concept of it was that I wanted something – a variety that was going to taste really great as a summer squash harvested at the ordinary summer squash stage, but I wanted to have something great to do with the things that got out of that stage – the escapees – that usually you put in a box and put on someone's doorstop in the middle of the night, you know. I thought it would be much nicer if that could be turned into good food that you could eat in the winter, like the Indians did with their dried summer squash slices. But I wasn't going to a whole lot of work to do that if it didn't taste good. So I had to have something that tasted spectacular. And the golden zucchinis, when they're dried that way, have got a really delicious flavor. And it's not anything like a zucchini or an ordinary squash. It's a big change in flavor that happens in the drying process. So, for example, the difference between a fresh plum and a prune.

Rachel Hultengren: Right, those are pretty different.

Carol Deppe: They just don't taste the same at all – they're completely different flavors. That's the sort of thing that happens when you've got a squash variety that responds nicely to the drying process. So the real advantage is being able to do this with regular summer squash. And so it turned out that one of the important characteristics to make a good drying squash was that the plant had to be planning on making really humongous, big mature fruits. If it was planning on making great big fruit, that meant by the time that the zucchini was even 2 lbs, which is way overgrown for the summer squash stage, it would still be prime as a summer squash but also great for slicing up and making into slices.

So one of the criteria that makes a really good summer squash that can be dried to produce this winter staple, is that the mature size of the squash is very big, so that it can escape beyond the summer squash stage and still be a good drying squash.

Rachel Hultengren: So it sounds like your vision for this variety was to have a golden zucchini that was really tasty when it was young, and that once it go older, it could be used as – it could be sort of a dual purpose squash and used later on for drying as a staple in the winter.

Carol Deppe: Exactly. It would be a spectacular dried squash and you could slice it in 3/8" slices and run it through your dehydrator and toss it in with your beans, for example, which the Indians did. And it

would take about as long to cook as the beans. Or, if I want something that makes more of an instant soup, I can run chunks of it through a salad shooter, and dehydrate those, so I end up with thin little slivers. And those will reconstitute in a soup in about five minutes and change the whole flavor of it, you know, add nutritional value, add substance, add flavor. It also makes a really good base for a soup, just all by itself.

Rachel Hultengren: So once you had this vision in mind for the new summer squash, how did you get started on the process of developing it?

Carol Deppe: So I wanted the golds, because I really liked the gold flavor, and there's an open-pollinated gold, but it's not very vigorous. The really vigorous gold zucchini around was 'Gold Rush (F1)' hybrid, and of course, I did not want a hybrid. I wanted something open-pollinated.

Rachel Hultengren: Why was that?

Carol Deppe: Because, for one thing, there's not really any advantage to a hybrid, for either the customer or the farmer or gardener, compared to the open-pollinated variety. You can't save the seeds, you've got to pay a whole lot more for the seeds, and you've got to buy them every year. So hybrids is not where I go; when I breed vegetables they're open-pollinated varieties that people can save the seed of.

Rachel Hultengren: And why is it important that farmers and gardeners be able to save their own seed?

Carol Deppe: I think that's critical for a lot of reasons. One, just including the basic resilience of the gardener and the farmer and the agricultural area. Because if something bad happens, and part of your resilience as an agricultural region, as a farmer or as a gardener, is being able to have your own supply of seeds. So that matters a whole lot to me. So I needed an open-pollinated variety.

Rachel Hultengren: So it sounds like it was important to you to end up with an open-pollinated variety that could be saved year to year, and maintain the same characteristics. What are some other things you were keeping in mind?

Carol Deppe: Another thing I had in mind was… I breed for organics. And I think that one of the most important characteristics of organic adapted varieties is just a general extreme vigor. And so instead of necessarily being resistant to this particular disease or that particular bug or whatever, the generally organic adapted variety just grows so fast it outruns all the problems. So if something's eating on its leaves it produces a lot more leaves and hardly even notices it.

So I thought, while I'm at it, why not try to make the most vigorous, fastest germinating, fastest growing squash on the face of the planet?

Rachel Hultengren: And what was your strategy for developing the fastest germinating, fastest growing squash on the face of the planet?

Carol Deppe: So instead of, say, just dehybridizing Gold Rush, what I did instead was the equivalent of crossing the two of them.

Rachel Hultengren: Can you tell me a little bit about exactly what that's like when you cross one plant to another? What is it you're doing?

Carol Deppe: For squash, the buds, you have to learn to recognize the male and female flower buds. It's pretty easy to tell because the females flower buds have a great big ovary at the bottom that just looks, totally, like a baby squash. And the day before they open, basically the late afternoon or evening of the day that the buds are going to open – in other words, you have to learn to recognize this particular stage – you go and seal the male and female flowers that you're going to want with tape so that the next morning the bees are not getting in there. So instead of the flowers opening the next morning, the bees getting in there and pollinating things every which way the way they want, you've got buds that wanted to flower but you've held them closed with the tape. So then you go and pick the male flower bud, rip the tape part off, take the blossoms off, and now you've got a little stick that's got the stamen with the loose pollen sticking up, and you use that. You take the tape off the female bud, and you just roll the pollen over the stigma, the receptive area on the female flower bud, and when you're done, you re-tape the female bud and you know, put a tag or a marker of some sort on it.

So basically I crossed the 'Gold Rush F1' to the 'Costata Romanesco' variety. And basically the reason for doing that is, in plant breeding, if you love the characteristics of two varieties, but you'd like some of their characteristics together, you start by doing a cross. So in other words, I wanted the yellow color and flavor associated with the yellow zucchini squash, but I was hoping I could get something that would germinate and grow even faster than both parents. Both of those varieties have got great big fruits, so I knew I'd be likely to be okay on that. And the F1 hybrid that I started with turned out to be heterozygous for the gold color.

Rachel Hultengren: What does that mean if it was heterozygous?

Carol Deppe: It had just one dose of it instead of being purebreeding for it. So in other words, half the progeny were yellow and half the progeny were either green or bicolored. And I wanted the ones that were pure yellow. I didn't want the greens. So I kept the best yellow and I self-pollinated that one. In other words, I crossed a female bud and a male bud from that same plant. And that became my basic breeding population.

So when I planted the seed from that out the next generation, I culled out the plants that had green fruits on them**,** the bicolored plants, and some of the fruits had stripes on them, and I didn't want those, so I eliminated the ones that did that. I eliminated plants that had small fruits at the mature stage, and so I selected that way for a couple of generations and what I ended up with was 'Goldini'.

And almost the best thing out of it, you know all these other things I was after specifically, but the very best thing out of it I didn't even plan. And that was it's got this spectacular flavor as a raw squash. It's so good as a raw squash that I just eat it that way a lot. I just slice it up into slivers and mix it with feta cheese, for example, and a little bit of Italian seasonings, and it's just really great that way.

Rachel Hultengren: So where you selecting for raw flavor as you were going through this process of evaluating every generation?

Carol Deppe: That was sort of the plant's idea. I always taste the squash raw, because you never really know where a breeding project is going**.** So when I'm doing a project, on the one hand, I've got all these theoretical ideas as to what I want. On the other hand, I'm pretty flexible and open minded and opportunistic. So I'm watching and seeing what the possibilities are, and if there's some other possible use or category that works better, I can change tracks. Well, so I noticed right from the very beginning

that nearly all the plants had this wonderful flavor, so yeah, I started selecting for great flavor raw, too. But it was more the plant's idea than mine, I just followed their lead, so to speak.

Rachel Hultengren: So it sounds like the process that you went through to come up with the zucchini was to find two parents that had qualities that you liked that you would like to see in combination in a new given variety, you crossed those together, and then every generation after that looked at the population that you had and picked out the individuals that had the best combination of those qualities you were looking for?

Carol Deppe: I'd make a distinction here. A lot of times when you're crossing two varieties, it's that one variety has got some characteristics that you like and some that you don't like, so you cross it with another variety that's got complementary characteristics.

So if one variety's got great flavor but it's smaller than you'd like, you might cross it to something that's bigger whose flavor is not quite what you want. This was something a little bit different from that. I wanted a yellow squash that was a great eating drying squash that wasn't a hybrid, and I also wanted even more ability to germinate fast and grow vigorously than was in the parent varieties. So what I was doing with respect to that was a trick where you're trying to get an improvement in the next generation by crossing two different varieties, both of which have got the characteristics you want. What you're hoping for is that they've got different genes contributing to that characteristic. So for example, if you cross two varieties that are the same size, can you oftentimes select out something that's bigger than both of them? And the answer is yes, because a lot of times they'll have different genes that are contributing to bigness in the two varieties. So you can select out a variety that's got more genes for bigness, you might say, than either parent. So that was one of the tactics.

And this thing is so fast germinating and vigorous it's really ridiculous. We plant all our squash in this field, and the 'Goldini' plants will be little plants that are 5 or 6 inches high that are already looking like baby bushes at the time the other stuff is still germinating and making their first few leaves.

Very often the way that squash varieties are developed, people will go through some series of crosses, you know, trying to combine the characteristics of this variety and that variety. So you start off doing a cross. And then after you've got that cross generation, the normal thing is to self-pollinate and in the generation after that you get all of the different genes assorting in all different combinations. People will select out their favorite plant of that next generation, and they'll self-pollinate that and then they'll self-pollinate the favorite plant from the generation after that and so forth and so on.

Each generation, they're actually losing half of the total genetic heterogeneity in the variety. And they actually want to do that, because they want very pure-breeding varieties. But I think one of the problems is that heterogeneity really contributes to the vigor of the plant. So what I did was something pretty different. I did just one generation of inbreeding, and then after that I mass selected. That is, I planted up a patch of maybe 60 or so plants. I planted maybe 5 or 6 times that many seeds initially, spacing them at 6" apart in the rows, 'cause I wanted to really strongly select for fast germination and fast early growth. So I then thinned out all the plants… basically kept the 20 % that were the fastest germinating. So then I ended up with about 50 or so hills, and instead of going through and finding one or a few plants and self-pollinating those, I let them all continue cross-pollinating except I culled out all of the green ones. I also culled out everything that was late flowering, because in a summer squash earliness really matters a whole lot.

The way plant breeders usually do is, they do these many rounds of inbreeding; they'll end up with something that's pretty much uniform for everything. And in fact, in order to qualify for patents or Plant Variety Protection, they have to be pretty uniform. However, I don't believe in any of those things anyway. And I wanted it not to be uniform; I wanted as much genetic heterogeneity as possible, but I wanted uniformity for just the things that mattered. And it matters that they're all summer squash bush types, and it matters that the fruits are all yellow and they're all delicious and good for the things that I want them to be good for and uniform for flavor, but it doesn't matter at all whether the leaves all look the same. And I thought, in fact, it would be fun to deliberately make sure that I kept as much variability as possible. So I've got green leaves and silvery leaves and leaves that are more lobed, and smooth edges, and ones that have got jaggedy… So you look at them and most people would say, that doesn't look like a pure variety. And I just write into my variety descriptions, if you want uniformity for things that don't matter, buy something else.

Rachel Hultengren: It's a fair warning. I'm curious how long the process took from the time that you decided that this was something that you wanted to take on, to deciding that you were finished with the variety and were ready to release it so that people could buy the seeds of it? How long did that process take?

Carol Deppe: How long did it take me before I was finished? I'm not finished yet. Because I'm still working on decreasing the remaining amount of genes for green fruit, and I'm still selecting for interior color – I like the interior color to be yellow and that's fairly variable still. I started selling seed as soon as I had a variety that I considered was the best summer squash variety in the world, frankly. It's so good that I've got no desire to grow any other summer squash variety other than this one.

But I'll continue refining it and polishing it. To get a basic variety, a lot of times you can get a basic variety in 4 or 5 years even starting from scratch. One that's better for your purposes than anything else out there. But is it completely finished and completely uniform at that point? No, not usually – you're still improving it at that point. But to get something that's better than anything else that exists for your purposes, actually that only took me 5 years.

Rachel Hultengren: Have you gotten any feedback from farmers or gardeners who have bought the seed that you released recently?

Carol Deppe: Actually, people love 'Goldini'. People seem to like it just as much as I do. There's one farmer in California who's selling it to grocers in California by variety name and he can get a farmgate price about twice as high as for any other summer squash. I think this is a variety where it makes a whole lot of sense for people who are marketing it to market it by variety name and encourage the grocery stores to market it by variety name.

Rachel Hultengren: So I'd like to shift gears here, and talk about the fact that you've pledged Goldini Zucchini to be open-source. And maybe I can just read the OSSI pledge here. This is the pledge that a breeder can make to say that they intend their variety to be open-source, and it appears on seed packets of all of those varieties.

The pledge says, "You have the freedom to use these OSSI-pledged seeds in any way you choose. In return, you pledge not to restrict others' use of these seeds or their derivatives by patents or other

means, and to include this pledge with any transfer of these seeds or their derivatives." Why was it important to you to pledge 'Goldini Zucchini' to be open-source?

Carol Deppe: Well, I believe that farmers and gardeners should be able to save their own seed and should be able to continue to develop varieties themselves. These were basic rights that humans had from the beginning of when they started doing agriculture. When you got your hands on some seed, it was yours. You could do whatever you wanted from it, you could grow the material, you could save seed for replanting. In the last few decades, increasingly, we're being stripped of the right to even save our own seed. I think it's a basic survival characteristic for a farmer or a gardener or for the agriculture of a region, to be able to save their own seed and do their own plant breeding.

So if I release the variety as public domain, it means that anyone can do anything they want with it. But it also means the big gene giant-type seed companies can come in there grab that variety and use it to breed their varieties and their varieties are all released as patented varieties. So as long as people like me produce varieties and release them as public domain varieties, and the gene giants have access to our genes and we don't have access to their genes, and they can build on our breeding and produce proprietary things that they restrict, and we can't build on their breeding at all, it's essentially a one way street. Basically, traditionally, commons that involve valuable things don't work if there are people around who want those things and there are not any rules. And what Open Source seed initiative is, is it essentially sets up the rules. You have complete access to this so long as you, too, are part of the folks that share seed rather than grab seed and try to make it private. You don't get to declare it's just yours. If you combine it with some germplasm of your own, that material's got to be an open-source variety, too.

Rachel Hultengren: Would you have any advice for someone who might be interested in starting a breeding project of their own?

Carol Deppe: Yeah - it's a whole lot of fun. The gardener… some gardeners are just trying to grow something that's exactly the same every year, and they find a few varieties and they just grow that over and over again, but a whole lot of gardeners are essentially explorers. They're trying new plants, they're imagining a different garden, they're always trying new techniques, they're inventing new techniques. Plant breeding adds a whole 'nother dimension to that sort of person's garden. Not only are you imagining varieties that are better and methods that are better than what you've got now, but you're imagining in terms of varieties that don't even exist yet. It takes things to the next level, because you're saying, "Okay I could check out all these varieties and find out what I like best, but what if what I like best is something that doesn't even exist yet? What would that be?" Gardening is basically a highly creative act for most people anyway and adding the component of breeding your own varieties is just a way of taking the creativity of gardening to the next and obvious level.

Rachel Hultengren: Well, thank you so much for talking with me today about 'Goldini Zucchini' and about the Open-Source Seed Initiative.

Rachel Hultengren: We've been speaking today with Dr. Carol Deppe. If you'd like to try Goldini Zucchini in your garden or on your farm, you can buy seeds from Fertile Valley Seeds, at www.caroldeppe.com. If

you're inspired by this seed story to start a breeding project of your own, her books have lots of how-to knowledge. They include:

Breeding your own vegetable varieties: The gardener's and farmer's guide to plant breeding and seed saving

The resilient gardener: Food production and self-reliance in uncertain times

The Tao of vegetable gardening: cultivating tomatoes, greens, peas, beans, squash, joy, and serenity

Links to those, as well as more detailed information about 'Goldini Zucchini' can be found in the Free the Seed! shownotes on the Open-Source Seed Initiative website at www.osseeds.org.

There you can learn more about OSSI, see details about the many varieties that have been pledged as open-source, and find out how to support OSSI's efforts to maintain plant varieties as a protected commons.

Let us know what you thought of the episode by tweeting @OSSeeds. You can find us and like the Open Source Seed Initiative on Facebook to join an online community of folks interested in the future of intellectual property in plants. If you'd like, you can give us a review on iTunes, which will help other potential listeners find us there. Our theme music is by Lee Rosevere. Thanks so much for joining us. Until next time, I'm your host, Rachel Hultengren, and this is Free the Seed!