PRINTED FOR Mark Freeman
Assistant Professor
School of Communication
619 594-5497
mfreeman@mail.sdsu.edu

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Ruth Kobayashi

I've been supervising research here at the Paul Ecke ranch for about six years that's when I started at the ranch essentially. In the laboratory is a supplement if you will to our poinsettia breeding program primarily, we do some maintenance tissue culture although poinsettias are not. What do we do here in the lab? - which is primarily taking the chutes of the poinsettias and dividing them and culturing them in a sterile environment with all the nutrient media for the plants to grow. With that, what we do is we'll try and do a little bit of mutation type breeding if you will, where we will add some chemicals to the media which will help the chromosomes double which our intent there is to have larger, more robust flowers. And then we'll have to take them outside and see how they'll do. Everything that comes into culture needs to be tested outside because you never know. We also do some embryo rescue, which is basically taking a premature baby and putting in a sterile culture and nursing it along because the nutrients that the plant would normally provide, the plant isn't providing, and to get those new hybrids that we're trying to develop we'll put these in culture and get the embryos to develop and make little plantlets and again we'll take them outside and evaluate them then.

Mark Freeman

What are the characteristics that you're trying to breed for?

Ruth

We're trying to breed for both aesthetic characters, large blooms, some of the things that we're working on and we're just in the beginning stages,

their scent, leaf color and some other post production qualities, like how long does it last in someone's home? And also we'll breed for horticultural characters which helps the grower grow the plant more easily. So how fast the plant will root, how tall, how quickly the plant will grow, how vigorous it is, all of those characters that help the marketplace bring new plants to you.

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Well, the fastest track that we bring the poinsettia out is four years, and that's the fastest that it could get from the inception of my idea of what kind of cross or hybrid we're going to make to being able to test it and grow it out to see how well it grows across country, to the marketplace. Normally, a plant will take from the inception point about seven years and that will give time for evaluation at the Paul Ecke Ranch, for a few years, we'll look at production characters, we'll look at keeping quality how long it lasts in the home before we take it off rack what we call where we'll test it in locations all across the nation where we'll evaluate it for a couple of years across the nation to see how well it does and once it meets the mustard, then we'll go for it.

Thirty years in development, that's true that would be, I think you're talking about Winter Rose. It has more of a reflexed brack as opposed to the smooth, flat brack. From the inception, it's great great grandfather is a plant called Ecke's Flaming Sphere, and that was found some thiry forty years ago out of natural sport of some field growing varieties. It doesn't have a lot of the good characters that we would consider necessary today as far as bringing on a new variety. But it did have sort of that in curved brack. It didn't have a lot of pollen so it did take thirty years of crossing and trying to hybridize and brining in new characters such as stem strength, leaf color, keeping quality, along with that curved brack and that took about thirty years.

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We, our selection rate if you will for poinsettias is less than 1%. I can't tell you if it was one one hundredth of a percent or one thousandth of a percent, I haven't done the math that closely. It's down in the less than 1% region, we'll look at ten thousand seedlings of which we might pick a hundred for the first year, by the second year evaluation, we're down to ten and then

when we look to see if it will grow across the nation, we're down at one or less per year that we'll look at. One out of ten thousand if we're lucky.

Yes, along with our hybridization work, we try to take advantage of nature's own mutation rate and enhancing that. We besides doing some chemical chromosome doubling or some spot mutations that some chemicals are good at, we also do some radiation work, which basically is using the same kinds of technology that medicine does as far as radiation therapy at a different radiance level, and we have several different radiance level that we use to expose or express the mutation. So it would be like getting a red flower to be pink, having a plant be a little more dwarfed. These kind of mutations are fairly commonplace.

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So how this works is basically we'll take a plant to a hospital and give it an x-ray treatment, of maybe not the same dosage as someone would have getting an x-ray done, a slightly different dosage, and that will help express the mutation in different color, different size, that kind of stuff.

We actually already do our research there, we don't do our breeding research there. In Guatemala. We do do some research there in Guatemala presently, we don't do any breeding research there yet, but that's not out of the question I would say. Primarily the research that we're doing in Guatemala has to do with providing a better plant production wise for our growers which is the first consumer.

Mark Freeman

Do you supervise the research in Guatemala?

Ruth

No, I do not supervise the research in Guatemala. Currently, we have a different research team. There's been a tremendous focus today at the Paul Ecke ranch to try and get that on a fast track. So we have to separate that, we have a lot of research going here with the breeding so we have separated that off.

Mark Freeman

Is there a challenge coordinating research internationally?

Ruth

Oh, definitely. There is a lot of challenge coordinating research internationally. We not only have time zone differences, there are different chemicals that are available locally that aren't available here in the U.S., or a different kind of formulation and as you do research you don't know whether or not that's going to make a difference. So you try to keep everything as uniform as possible, but you want be able to utilize everything that you have locally. The primary objective for applied research if you will, and that's the kind of research, the term that we would use, is because it's research that we're using to help grow a better plant rather than using basic knowledge, where using it for application purpose. So this kind of applied research, you want to be able to use what's there, because that's what you're going to be using for your production process, so you try to use everything locally, you try to do the research there to try and mimic what the production process is going to be.

That's challenging because we may not have exactly the same kind of chemicals, same formula, sometimes there is a difficulty in mimicking from the U.S. to off shore facility. The same kind of environment, the same production practices if you will. If we're shipping cuttings across, there are shipping challenges that you wouldn't have to incur.

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Yes, there have been plans to develop a biotech center in the front lawn of the Paul Ecke ranch property. The primary objective is agricultural research, the Paul Ecke ranch as a horticultural business, there's not a lot of, each commodity is very small, we have hundreds of different plant material, species of plants that we sell and work with, but each one is quite small and doing biotechnology research is very expensive and the return on investment is difficult if you don't have a large commodity to back that up. So the best case scenario for us is that we would have a partnership with researchers that are working on very large commodities like corn or soy bean or something like that that isn't really specialized part of the business and learn from them, collaborate with them, use some of their technology and information and see if we can adapt it to our plant material.

Well, that is our ultimate goal, is for consumers to benefit from anything we develop. What would that be? Some people say it's scented plants, fragrances that aren't available that would add something to their quality of life. Plants that are easier to care for in the home, that are longer lasting, although poinsettias last a fair amount of time these days, we've done a good job in developing better lasting poinsettias. Things that are easier to care for help the consumer enjoy the plant longer, and that's really what it's about, it's about the consumer enjoying what they have.

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No it's not a rose. Nature's already taken care of that. A scented poinsettia would be, actually it's hard for me to describe, what I would say a scented poinsettia would be because we haven't quite developed it yet. I would try to breed for, if it were easier to direct what we could do, actually a lightly scented flower, because during the holiday season which is when we see most poinsettias. We have a lot of different scents already, we have pine, cinnamon, we have a lot of these traditional holiday scents. As far as having your poinsettia be slightly scented is better than having it compete with these strong scents. But it would have a very subtle kind of as you wisk by, you go oh I smell something and that's very nice. That's my idea of what a scented poinsettia would be like.

Scent is actually very complex. So as far as doing biotechnology on scent, although we are getting more and more genes available and researchers are finding genes that control certain different scents. It's fairly complex and wouldn't be that easy to do.

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There are risks in anything that you do as far as biotechnology is concerned, it really isn't any different. I think one of the things as researchers become better at is understanding that there are a lot of risks and so the amount of testing that goes into the development process before it reaches the market place is much more stringent today primarily because of a lot of the work that the biotechnology industry has done in saying yes, we realize as we look at the DNA and as we understand more of what's going on gives us a lot of insight into understanding hey, you know there are a lot of things that

we don't know and we should be as diligent as we can in testing the plant material for anything we think could have changed.

One of the things that we would test for is weediness. And weediness if you will is there have been reports that people have been worried that the genes will escape and go into another plant. well, that's one kind of way people are afraid, and we test for pollination and things of that sort to see whether or not the genes could transfer from a cultivated species to a non-cultivated weed very easily. The other thing is that sometimes as plants changed, you don't know that they become more vigorous, in a different environment where as we cultivate plants, plants may come from Costa Rica as their natural habitat. And we bring them into the US and we send them across country because they have such beautiful bloom and in certain areas, they go wild. The plant has everything it needs and it loves the climate and becomes a weed if you will, it sends seed out and it grows very nicely although most people wouldn't have planted it. so things like that are attributes that we look for, test for, as well as in floriculture or turf grass or things you don't eat, you don't look for, or don't need to look for entering into the food chain, but that is as far as edible plants, that's something that the researchers look at, chemical changes in the plant, the end of the food chain.

There are some breeding work that we do, and we do that by natural hybridization, if you're talking about biotechnology for decreased pesticide use, there are actually a number of genes that are available in terms of having insect and fungal resistance and some herbicide tolerance, things of that sort, so you need to use less pesticide in the process of growing which help the environment.

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The technology of that some of the chemical companies, and actually most of this work is coming out of the human/animal research, pharmaceutical research is a term called apatosis, which is cell death. Directed cell death. So that does help confer resistance and if you think about bacterial invader or a fungal spore invading a cell, making it sick and cascading events of other cells, dying before the bacteria enters the blood stream of a human, or the flow life stream of the plants. So the plants actually kill off its cells as soon as they detect that there is an invader. That's a protection mechanism. That is quite exciting because if it were broad spectrum where it was

effective against a series of type of bacteria, or a series of fungal invaders. We have to use pesticides. And the plants will be able to because there will be bacteria and fungal spores around all the time, you just don't want your plant to get sick by them.

Gene or sequences that you're talking about at a company called IDUN is working on. I don't know what the sequence is but I do know how it works and I have talked to them.

Well, they're not really taking a human cell, how this works is they're taking the code for this human gene which is part of a cell mechanism. So they're taking that code and putting it into a plant like most of the basic research like tobacco is kind of like the lab rat if you will of the plant world. So they'll take the code and integrate it into the plant. So that's not so extraordinary because if you look at the genetic code of all living organisms they're remarkably similar. To say that you could take a code that you got out of a human, may only be one or two base pair difference in the millions of base pairs that are part of the genetic code for a certain gene, so it's only one or two base pair differences from a human to a rat to a plant. there are actually basic cell function types of genes and code that are remarkably similar as you go along all the biological organisms.

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As far as a single story or an anecdote, it's difficult because there's always an emotional kick part of the job. Nature is so unpredictable, no matter how well we plan our experiments, no matter how well we think that we understand the plant and we make a specific type of cross and we think we're gonna cross A with B and we're expecting to get C. Every year, it throws us a curve ball. And that's really the excitement. Is that you think one of the things that we're trying to ? in the color range and so we were making a series of crosses and I wasn't really expecting, because you don't know all of the chemical components of the color pathway that are involved in poinsettia. I wasn't really expecting to get kind of like a pumpkin orange color, we were trying to get a dark leaf pattern and certain other things and it was a scrawny little plant and we affectionately named him Orange Guy and he was pumpkin orange, amongst a sea of red and there was this scrawny plant and it had orange bracks, and it was really that was actually a very exciting day because nature had shown me that there was a way to break into orange color. No, it's not ready for commercial

application today. It doesn't have all of the horticultural attributes, all the good growing attributes, it doesn't have, it actually does have fairly good keeping quality, but that was kind of serendipity, but it doesn't have all of those things that go around and make it a commercially viable plant. so but that's kind of nature showing me that you can do something like that, we can get pumpkin orange if we wanted to, I don't know how many people will buy pumpkin orange, but we can get there. Things like that where we are doing some of our inner specific hybrid work where we cross a white flower with another white flower, although they're different species, I wasn't expecting all the hybrids to be pink, but they were. And they were a vibrant pink, a pink I haven't seen in the poinsettia species and so it was quite exciting. Someone dumbfounded, how did we get pink with white and white? That doesn't make any kind of sense. Things like that, we run across every year and that's what makes the breeding work so fascinating, is that when you think you know what you're doing, nature always shows you that you don't.

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Actually, we have been doing some research on DNA fingerprinting to protect intellectual property, which is essentially protecting the plant itself. So that others who may less scrupulous will take our plant, illegally propagate it, sell it without having to pay for any of the development costs which is bad for the industry. Because it does cost everyone something to develop a new variety, something new and exciting to the marketplace, there is cost involved with that. And for people to come and just take something you've developed and the developers cannot make enough money to put back into their program, we can do a number of things that will come out. It weakens the industry. So in poinsettias, we actually have started research project with North Carolina State University which focused on the feasablitliy of DNA fingerprinting for poinsettias to distinguish between cultivars. And it's a fairly far along in its process and we feel that there is good hope that we could use DNA fingerprinting someday, we have a nice catalog of information of all of the sequence, or fingerprints for a number of commercially available varieties today. North Carolina State is also looking at a number of different floricultural commodities to see if they can build another catalog of information so that people in the industry, like the Paul Ecke ranch can utilize this information and say is this new variety that looks very similar from my competitor it looks identical almost, is it really genetically the same or similar enough that we can say this is too

similar that it must be mine and we're very close to that point. What it would take is not only adoption from industry but also from the overseeing organizations in Europe there's the CPVU and the US patent office to be able to use this information to be able to say, yes, in conjunction with all of the other attributes that we can see visually we can look at the DNA, we can use this as one more piece of evidence that the plants from, these two plants that look very similar are indeed from the same origin.

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If you think of the DNA fingerprint, the code, the DNA in the plant itself, the plant cells, as a long chain of code, As and Bs and Cs, it's a long chain of four basics and the order in which this code goes has an infinite number of combinations because we have millions of these bases, so if you think of it that way, that all is a chain of this code, and there are infinite ways that the code can, an infinite order, and we take slices of this code and we look at it and we say this slice has a code in this order and another slice has code in this order, and we compare the two codes and since it's infinitely possibilities, the likelihood that one code or the series of codes are the same is very small, and that's how the finger print works. They say that the fingerprints on your hand, is that your pattern of your fingerprint is very unlikely to be the same as the pattern of you neighbor because how the circles on your feet and your hand fingerprint go is quite unique because of the infinite ways that this can happen. And so the DNA fingerprint is that, is that the code itself is that it can go into so many different orders, we can match it or not match it.

I think agriculture or horticulture is in general misunderstood. It seems so simple because we get food on our table everyday, we have flowers at our corner stand, it's quite plentiful, it seems very easy that the truth of the matter is that there's a lot of research and development that goes into and continues to go into developing new flowers. I think some of the things, the technology that we use, most people don't imagine that that's what it takes to bring something like this to marketplace, that it's not as easy as walking by the roadside and picking up a beautiful rose, that rose went through love and care, many hands to get to the roadside. The same for our food, I think that we take for granted a lot of these things. That, I think is one of the most rewarding things is that a lot, this is hidden and people don't struggle for it and we think that it's easy but that fact that it's not and people don't know about it, I think is really in some ways some of the great

treasures that people don't see, or one of the great treasures that I have, is that I'm fascinated by this, and I wish more people would be able to see that. Because it is so complex, it is so rich in it's secrets. That colonel of corn sitting on your plate has a lot of secrets and that's what I think is the fun of this job. That poinsettia that you bring home for Christmas that sits on your table has a legacy of stories to tell. You just have to listen.

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There are definitely challenges as far as being female researchers, I think over the years we have made some gains as far as being female in the work environment, in agriculture especially, there's a lot of good old boys, if you'll allow me to say it, but that's changing. And I don't think our challenges are any more unique than anyone else in the workforce, and in fact in some ways I think in floriculture, because a lot of women like flowers, there is not as much difficulty.

It is a preference I guess. There's, actually in my academic career I don't think I've ever had anyone tell me I couldn't do something. One of my professors actually was saying well, you don't really want to go out in that corn field and stomp around, wouldn't you rather be in the greenhouses with these beautiful flowers? Because he was doing this research and he was wanting to have students interested. And it just struck me as you could pretty much do whatever you wanted, if you wanted to stomp around in that corn field, well, by all means you could stomp around in that corn field.