

ARIZONA SERIES – ARIZONA GREENHOUSES INTRODUCTION

Gene: Welcome to Arizona. I'm Dr. Gene Giacomelli from the University of Arizona's Controlled Environment Agriculture Program. It's a pleasure to be here today to give you a brief introduction to the greenhouse crop production industry here in Arizona. Arizona is a variety of weather conditions, from the low deserts that can be brutally hot in the summer time and very cool in the winter, up to higher elevations where we can have snow in the winters and cool summer days, very good for controlled environment agriculture. The rainy season is twice a year but we only get twelve inches total per year, so very little rain. It's a desert, arid climate. Water is very important to our industries and water use efficiency as you'll see will be very, very important. The greenhouse vegetable industry in Arizona is the largest in the country. There are about 250 acres, primarily of greenhouse tomatoes, grown in the Arizona climate.

EuroFresh Farms is the facility that you will be visiting during this video. Their goal is to produce the highest quality, continuous production of tomatoes throughout the year. They also realize that they are in the desert, an arid zone that has limited water resources so they utilize their water very effectively. You'll see their hydroponic systems. You'll see their nutrient recycling systems and you'll see how they drip irrigate each individual plant. So they are very, very good at saving water.

We realize that the future of the industry will depend on good growers such as this using high technology information and equipment and well-educated students to move on and move the industry ahead. We hope long-term that because of the efficiency of water use, the increased productivity, and the value of crops that can come out of the greenhouse that the field industry will be less critical as we go down the road given the fact that their efficiency of water use is much less than in the greenhouse.

With this brief introduction I hope you have an enjoyable time in this video, seeing what we have to offer here in Arizona from the standpoint of crop production in controlled environment agriculture.

ARIZONA SERIES – EUROFRESH FARMS INTRODUCTION

Gene: Hi. I'm Dr. Gene Giacomelli from the University of Arizona Controlled Environment Agriculture Program and it's a pleasure to be here in sunny, Southeastern Arizona in Wilcox with Damian Solomon production manager here at EuroFresh Farms. Damian is going to tell us a little bit about the facilities and the production practices that go on here and maybe we'll start off, Damian, with a little bit of history. How did EuroFresh Farms come to Arizona?

Damian: Ok Gene. EuroFresh Farms is a Dutch-owned greenhouse. The owners came from Holland. The reason they came from Holland is because the industry there is so intense. The greenhouses have been there for decades now. The technology is there. Everything is evolving from there in greenhouses and the reason they came here was

became they are space-limited there, so they are not able to expand large greenhouses on a confined space.

Gene: I see. Are there any environmental reasons why you came to Arizona?

Damian: Yeah. The reason they came to Willcox specifically is because we have great light. We have the perfect altitude. We have the availability of very clean fresh water. We're close to an interstate and also we're close to a labor pool.

Gene: I see. Does the altitude have something to do with temperature? I think we're in the desert here. I would expect it to be too warm.

Damian: Well the reason we chose this altitude is because you have mild summers. It does get warm but as I'll explain later, with our climate control system we are able to keep that within control.

Gene: Excellent, excellent. What kind of tomatoes do you grow here? I noticed different sizes and shapes. Can you say a little bit about that?

Damian: Yes. We grow truss-type tomatoes on the vine, what you see behind us here, and that is picked on the vine, five tomatoes on the vine and we also sell and market our Campari-type tomato which is a smaller salad cocktail-type tomato.

Gene: I see. I see. Where are your markets? You grow an awful lot of tomatoes. How many tomatoes do you grow here in a given year or what number can you tell us?

Damian: Well last year we grew roughly 82 million pounds of tomatoes company-wide which equates to about 250 thousand pounds a day produced.

Gene: A quarter of million pounds per day of tomatoes. Who eats all these tomatoes and where do they go?

Damian: Our marketing is stretched all across America from east coast to west coast, north to south. We have several distribution centers located around the United States and several large customers, WalMart, Costco, those kinds of markets.

Gene: Damian, this seems to be a huge facility, a real high technology tomato plant factory. How large is it and how did you grow to be this large?

Damian: Currently EuroFresh is 165 acres, growing by 40 acres in the next couple months so it will be roughly over 200 acres of production area. We started out very small when the company started in 1991. They came with a ten-acre plot. Then they got that ten-acre plot producing and then expanded ten acres. Expanded that 20 acres and that completed Site One. Then we came into Site Two, completed 20 acres, got it producing, went to Site Three and so on and so forth. The reason to do that is so that we can pay off some of our debts and not keep as much overhead.

Gene: Ok. You have those debt problems as well. I can understand that. How many sites can you actually fit here? What would be your maximum size that you could go to?

Damian: Scheduled for the future are six sites here.

Gene: Six sites. Ok. Well I'm really excited. I was hoping that we could now beginning looking at some of the details of the facilities.

Damian: Ok. Great.

ARIZONA SERIES – LIFE CYCLE

Damian: Being a greenhouse tomato company, you see behind me all the tomato plants. They didn't always come this big. They came in from when they were real tiny. So we get the plants in from a nursery company. They come as transplants. They come in this little cube you see here and they come about 10 inches tall from the cube. What we do is then we plant them on this Rockwool mat that is already here. The dripper is already here so we plant the plant and we put the dripper in and we're done. What we will do next is we will tie this string on to it, which later you'll see this high up. And this is to support the plant because it is a vine-type tomato so we have to give it its support via these strings and hooks. This mat contains all the roots. We are a hydroponic greenhouse that means we do not use traditional soil to do our growth. All the roots are contained inside this slab and this slab you can pick it up and it's sitting on top of this trough system.

This trough, what the trough does it contains, or we use it to collect the drain water. Each bag has a slit in it. The water comes in via the dripper. It goes through the system and whatever drains out is collected to use later in the recycling system. The fact that we don't use soil we have to irrigate our plants and every time we irrigate them we have to give them fertilizer or chemi-gation. This is the dripper that we use to actually give the water to each cube and this is the sub-main or the sub-lateral that we call it which is connected to the big main valve. Water comes through here and it comes through this dripper which is then dispersed on to the cube and the rootstock. As the plant grows and matures we will support it via this string system here, connected to a high wire.

As the plant reaches its maturity age when you can start picking the fruit off it will have 8 to 9 depending on the variety trusses or vines which you see here in my hand before it starts to ripen. It will ripen from the ground up so as you see here this truss is ready to be picked. When we go to pick it we will pick it from the main stem here. Clip it here. These are vine or on-the-vine varieties so we have to harvest the whole truss mature so we will take this last tomato orange before we harvest this tomato.

So from the greenhouse after the tomatoes are harvested they will come into the pack house via the little carts that you saw earlier and they will be unloaded onto these conveyor belts. So you see here there's a line of boxes ready to be packed. Behind me you'll see a pack house worker. What she's doing is she's taking that box, making the weight on the scale, taking maybe one or two clusters of tomatoes out, putting another one in just to make the weight. Once she makes the weight from here she'll put it on the conveyor belt and the conveyor belt will go around and each individual tomato will get a sticker placed on it and that goes to the sticker machine. Once that's done then we have people who palletize the boxes. After it's palletized they get stickered and tagged to the destination and bar-coded to the destination that it needs to go to that way we can identify it in the distribution centers and the market can identify it electronically when it arrives at their warehouse.

ARIZONA SERIES – PEST CONTROL

Gene: We're here with Karin Hallborg, assistant manager of bio-control at EuroFresh. She's going to tell a little bit about integrated pest management and how she deals with insects and diseases here in the greenhouse. Karin?

Karin: Thank you. Well the key to integrated pest management is scouting. You've probably heard that before. You really need someone out in your crop every day looking at the crop carefully in order to know what's there. At EuroFresh we have one scout per every greenhouse or one scout per about every 20 acres. They work very closely with the supervisors and the managers or the growers here EuroFresh. A grower can just go up to one of our scouts and say what do you see in our crop and our scout will be able to tell them.

Gene: So when you find a problem what are some of the tools that are at your disposal to solve the problem.

Karin: Ok. It depends on the pest. If we have white fly, which is our most common pest in EuroFresh, it depends on the numbers that we have. What we do is we monitor the sticky traps every week according to this map here. The black lines, the dark black lines, represent bays and the highlighted yellows with the numbers in them, those are the specific numbers of each card. So if we know that there's a certain number of white flies on card 20 we know exactly where that is referring to.

Gene: So when you find the white fly on the sticky traps and you go to the plant and you find them there, what do you do?

Karin: Well what we put out, and just about every week, are these cards that contain beneficial insects which then leave the card and find the white fly on the plant and attack and kill the white fly.

Gene: Ok. Now does this destroy every white fly in the greenhouse?

Karin: Not every but enough to really reduce the white fly population and stop it from expanding.

Gene: So you keep a combination of bad guys and good guys? It's like bug wars continually?

Karin: Exactly.

Gene: Ok. So does that mean it's important for you to be careful what applications you put in the greenhouse for controlling all insects? Could you actually kill all your beneficials?

Karen: Oh yeah. There are certainly lots of pesticides out there that are very negative on beneficial insects, including bees. And therefore that's one of the reasons why you don't just spray pesticides.

Gene: Ok. White fly has been your biggest problem. Just name a couple of other insects that are also problematic.

Karin: Well first off there are two types of white flies that are differently problems, or different types of problems. We also have thrips, russet mite, spider mite. Those are basically the main arthropod pests.

Gene: All right. You mentioned bees and in this ecological cycle that you have in here, how do bees come into play?

Karin: Well bees of course are used for the pollination of the flowers. The hives contain full working hives. They contain a queen who's laying eggs, larvae and workers that go out to collect the pollen from the flowers in order to feed the hives. They work any time the sunlight is out. They don't demand vacations or sick time or anything like that so they are very efficient pollinators and they're more economical than labor.

Gene: The integrated pest management program requires labor, time, and energy. It is a nice ecological alternative to just direct pesticide application but how does that work in the economics of the situation.

Karin: That's a good question. It actually ends up being quite economical because those pesticides are pretty expensive and we need to have, or trained people are required in order to put them out and those people cost a lot more money. If you were going to just say every 'x' number of weeks we're going to put a treatment out it wouldn't be nearly as cost effective as what we're doing.

Gene: Now in the marketing and the sale of the product is there something you can say about this being biologically controlled?

Karin: Well we often use the label pesticide-free or beneficial insects were used something like that and for the educated consumer that does mean something.

Gene: Absolutely. Karin we talked about the insect problems in the greenhouse. Are there other problems that you have to deal with on a daily basis?

Karin: Yes. If the environment is perfect for growing plants, it's perfect for growing lots of things like viruses, bacteria, fungus.

Gene: I see. Are there any ones in particular that are more troubling to you than others. This is such a dry climate. I thought fungus and bacteria needed moisture to propagate and grow?

Karin: Well it's not dry down there by the root zone where we have lots of irrigation going on.

Gene: I see. So your modified environment truly is available for them to grow.

Karin: Right. So our scouts also when they're in the crop looking at the insects, it's their job to look for other diseases that are in the crop as well.

Gene: So when you search for new scouts do you give them an eye test as their first responsibility?

Karin: Actually we do.

Gene: Really. I was just joking. <laugh>

Karin: No. I show them things on the card and say 'Can you see this?'

Gene: Can you see this? Then you recognize that. And then they need to be able to communicate with you. So these are some capabilities that they would really have to have.

Karin: Yeah. Right.

Gene: I see. Does a scout work only during daylight hours, is it a long, hard day? Do they get a lot of breaks so they can...?

Karin: Well, right now our scouts work four, 10 hour days. It's pretty rough but in order to get an idea of what our situation is in the house, to take action earlier enough for it we feel that that's a necessary thing to do.

Gene: Ah. I would bet timing is very critical, the sooner you can learn about the problem before it becomes a major infestation.

Karin: And we go down the same row and check the same cards at the same time every week.

Gene: I see. Very well organized.

Karin: Yes.

Gene: Congratulations.

Karin: Thank you.

ARIZONA SERIES – LABOR ISSUES

Gene: Damian, there's a lot of tomatoes here. You talked about harvesting a quarter of a million pounds per day. That must require a lot of labor. Can you tell us a little bit about that?

Damian: Yes. What we do here as you see behind me is a picking cart that aids in harvesting. What that does is that holds all the boxes and the worker will go down and harvest and put the tomato in the box but that's not the only job they do. They also do crop work. These plants grow 20 centimeters a week and we need to take care of the crop to make sure that it's suspended on a string, to make sure that the trusses are pruned to the correct number of fruits, we also need to do de-leafing and lowering as well. All those jobs and the labor they're done on contract piece-rate so the worker will get a certain dollar amount per row per job and actually we have some workers, our fastest workers, who make a lot of money a week, upwards of 800, 900 dollars a week so that keeps them very happy. It is 12 month a year work. We're protected so in the summer we're nice and cool and in the winter we're nice and warm so there's no reason for them to leave. They make good money. We try to keep our people happy that way we keep turnaround down to a low level.

Gene: And I noticed that you're able to converse in another language. Is that helpful here?

Damian: Yes. Our labor force is primarily Hispanic and they speak Spanish. And I'm lucky enough to have learned Spanish at a young age so I can very easily communicate with them.

Gene: Excellent. So how many people do work here and how do you keep track of all of them?

Damian: Well roughly now company-wide we have about 500 people working for us. In my greenhouse alone I have 24. Those 24 people are responsible for all the jobs. And what we do is we have a crop supervisor who checks their quality of job and makes

sure they're doing the job correctly but he also records the rows that they do on contract then at the end of the day he enters that into a computer program which computes how much money they get and that's automatically linked to our payroll system so every week they automatically get paid on what's entered.

Gene: Now you're the production manager of this one block. How big is that?

Damian: This one block is two and half acres.

Gene: Two and half acres. And do you compete, I'll say that word in a friendly way, with the other production managers to have the best quality, the most per year? Is there a bit of competition here?

Damian: Oh yes of course. You know we hold a small competition. At the end of the year the company will give out an award for the production champion so the person who made the most tomatoes or produced the most tomatoes for the company. It is a small competition but it's nice to walk around and brag for one year that you were the top dog.

Gene: That you were the best.

ARIZONA SERIES – USING COMPUTERS

Gene: Damian, can you tell us a little bit about how computers are being used to help in your production system here?

Damian: Yeah, well basically the entire greenhouse is run by computer. Everything is computerized; the climate-control system, the irrigation system, the alarm system. Everything is computer-controlled. We have the different programs that we use here are Hoogendoorn and Priva. And those are two companies that offer computer-control software. They're both Dutch-based greenhouses again because that's where the industry is so intense and the new technologies come from there. Basically that's the two competing companies. We're trying them both out obviously because we can get the same service and maybe a cheaper price from one of the separate companies.

Gene: Do you collect a lot of information about the environment and about the plants with the computer and then use that in some way?

Damian: Yes we do. Both computer systems have a way of graphing historical data so we use that data a lot in the decisions that we make the next day or also we can use that data for the following year. We can say hey at this time during these days or these months we did this and this is how it came out and we can replicate that or come close to replicating that for the following year. So it also gives us some type of future expectations.

Gene: Would you say that the ability to steer the plant as you described, to make it vegetative or more generative, is doable now because of the computer?

Damian: Yah, one hundred percent.

Gene: It helps?

Damian: Because if not then we would need a lot of people, a lot of labor force to man the windows to turn the fans on manually, to do a lot of things manually and the computers have allowed us to do everything basically remotely.

Gene: Sure, sure. What about in the computerization and where it's going in the future? What would you wish for or what do you foresee in the future with computers? Where's it going for you?

Damian: Well basically right now we have our computer terminals in our office and in the corridors of the greenhouse. One step we're taking in the future is that we're going to be, all the growers, production managers, they will have access to a palm pilot where we can do all the changes and all of the computer programs actually on top of one of the carts in the greenhouse. We can do it right then and there, live.

Gene: Right then and there?

Damian: Yah.

Gene: Wherever you are? Wireless connection?

Damian: Yah.

Gene: Fantastic.

ARIZONA SERIES – MARKETING

Gene: We've moved inside to have the opportunity and privilege to speak with Dwight Ferguson, Chief Marketing Officer of EuroFresh Farms here in Willcox, Arizona.

Dwight, we've seen a lot of the systems. We've seen beautiful tomato plants. We've seen a tremendous amount of tomatoes. Now, I know the challenges that you must have in marketing these tomatoes. Can you give us some insights, some idea of how you survive out there in that difficult world of marketing?

Dwight: Right now, we're actually quite fortunate in that I believe we're operating in what I refer to as the sweet spot of the produce industry. A lot of very positive consumer and industry dynamics are affecting greenhouse grown crops today. I mean, number one, we know per capita consumption continues to expand consistently. Americans are now eating more than 20 lbs of fresh tomato products per year. Obviously, that's having a positive impact on our business. There's also a definite trend toward the greenhouse grown crops, and that consumers, for all the right reasons, for taste characteristics, for freshness, for quality, firmness, pantry performance in their homes, are selecting these crops over the field grown crops. So, we're seeing a fairly dramatic shift there as well. So, not only are Americans eating more tomatoes, but they're eating greenhouse grown tomatoes, and that is certainly having a very positive impact on our business.

Gene: It seems that you have the privilege these days of dealing with a more educated consumer. Those that want information about the quality of the product, how it was grown and how it was treated prior to the time that they're going to consume it. The amount of the consumers is the question I'm focusing on here. In the US are we reaching our limit in who we can market to in numbers?_

Dwight: First of all, I don't think we've come anywhere close to reaching our limit as it relates to the consumption of greenhouse grown products. I mentioned earlier that we're seeing a dramatic shift in consumption toward these kinds of products, and I think we will continue to see that shift going forward. Last year, we know at retail these products accounted for roughly 38% of the tomatoes that we're consumed. It's estimated that this year it will be closer to 40% as measured in retail dollars, and I would anticipate next year will be closer to 42%. So, we're on a roll as it relates to growth trends.

Gene: Dwight, we saw a number of different types of tomatoes grown at your facility and their numbers out on the market these days. Can you tell a little about the diversity of products that you have now and that you might be considering for the future?

Dwight: Sure, one of the benefits of the way we grow, is the fact that our greenhouses enable a lot of flexibility relative to product selection. So, we are continually working closely with our customers to identify what types of products, even more specifically what varieties of products we feel are going to provide the most benefit to consumers at the end of the day. One of the things that we're doing quite a bit with, right now, is working closely, again, with our seed suppliers to identify what particular varieties provide the attributes that are most appealing to consumers relative to taste. We know that a lot of the seed companies are starting to breed crops or product varieties that have higher taste benefits or attributes than perhaps some of them that have been grown in the past. We're also looking for ways to enhance benefits such as, antioxidant levels within the crops themselves. Lycopene, for example, is a very important antioxidant which can be found in the Campari or the TOV crops that we are growing. We know that certain varieties may have higher lycopene levels than others. So, therefore, again we're working closely with the seed companies to identify which products have more of the positive attributes that nature, naturally, instills in these products to begin with.

Gene: Dwight, the greenhouse is a complex integrated system ranging from growers who have to do their thing to make the plant grow to designers, engineers who have to provide systems that work. To keep it operational you need a whole crew of people and finally you get a product and then it's your challenge to market it. In this big integration of all of these components of your business what is your greatest challenge or what do you expect to be your future greatest challenge?

Dwight: I think any company, like EuroFresh Farms, which is committed to being the best at what it does, will continue to seek out challenges in virtually every aspect of our business. We take very little for granted, whether it has to do with seed selection, whether it has to do with the technology that goes into expanding or even maintaining our greenhouses, whether it has to do with all aspects of production, operations, packing and distributions. Ultimately, all the way through to our sales and marketing efforts. In every aspect of our business we continue to find challenge or maybe better put opportunity to further enhance what it is we do.

ARIZONA SERIES - NUTRITION

Gene: We're going to talk a little bit about nutrients and irrigation. Damian, how do you provide these to the plants to keep them alive and well and growing?

Damian: It all starts in the irrigation room. In the irrigation room the fertilizers are mixed. We use soluble salts. Our fertilizer technician will mix the stock tank then the computer will take those stock tanks and dose it into fresh water into what we call a mixing tank. From there the water is mixed to a certain fertilizer level or EC the way that we measure it and it comes to the greenhouse pump via underground piping. Now, here you see this white irrigation line. The water is pumped through the main line into these sub-laterals and here it's pumped into the dripper where it is delivered to the crop. It is delivered to the crop several times a day depending on the season. In the summer we give up to 30 maybe even 40 irrigations every 15 minutes, one every 15 minutes. In the winter, we may go every 4 to 5 minutes every hour.

Gene: Damian, it seems that you use a lot of water. Where does it come from and the drainage where does it go?

Damian: O.K. Gene. The water we get from our underground wells. Each site has its own water well. We pump up the fresh water. We put it in the mixing tank and it comes to the plant. The plants will use what they need and then the drainage is collected in these troughs that we have. All the drainage goes to the back of the greenhouse. It is collected in the silo and it is run through ultraviolet filters. This ultraviolet filter what it will do is kill all bacteria, fungi, and some viruses.

Gene: Damian, we are out in the desert and we realize that recycling is very important. Can you give us an idea of how much you can recycle?

Damian: Yeah, Gene. We collect 100% of our drainage and currently, at the moment, we recycle about 45 to 50% of the water.

ARIZONA SERIES – STRUCTURES

Gene: We're now standing in one of the newest sections of the EuroFresh Farms greenhouse complex. It's a very new structure that is lightweight relatively tall and is covered with glass. And I was hoping that Damian could give us a little insight as to why this particular structure was chosen?

Damian: O.K. Gene. This structure was chosen for several reasons. The structure itself is large span gutter-connected greenhouse which was chosen for its strength and durability, also because it was one of the newer technologies in Holland, where it came from. The covering or glazing that we use is all glass. The reason we use glass is because of it allows high transmittance of light. It's very durable and also it's cost-effective compared to other similar glazing out there that would offer the same amount of light transmittance.

Gene: And, I notice that it is very tall. At least it seems exceptionally tall. Can you tell us why?

Damian: Yes, the reason we use this type of height or this height that we use is because it allows more of a buffer, an air buffer layer above the crop. That way in times of heating we can effectively keep that almost a warm blanket above the crop and also in times that we need to cool that air allows us time or energy savings with the fans.

Gene: I see, so you mentioned air temperature. Both trying to keep it warmer in the winter and cooler in the summer. I presume cooling is your biggest challenge? How do you solve that or attempt to solve that?

Damian: Yes, our biggest challenge is cooling in the summer months because of the extreme temperatures even though we're at a higher elevation we still in peak times, in peak summer we get high temperatures, and to effectively combat it we use our cooling system. We use our cooling system, when our natural venting can no longer handle the temperatures. We use a cooling system similar to a home evaporative cooler, where we have the fans on one side and we have the cooling pad on the other side of the greenhouse. And what we do is we will pull the air through the greenhouse and exchange the air in the greenhouse with the cooled air coming in from the outside through the pad.

Gene: So, the high levels of solar radiation that you get here in Arizona are a benefit for growing the plant, but it becomes a challenge because it also lets, it also provided a lot of heat that you have to dissipate out of the greenhouse.

Damian: That's correct.

Gene: And primarily you'll start off with natural ventilation and do that as much as possible?

Damian: Yeah, that's correct

Gene: Until it doesn't function as well as you would like?

Damian: Yeah.

Gene: Does the evaporative cooling system provide other benefits other than just cooling?

Damian: It allows us to keep a certain humidity level in the greenhouse. Which is important for several reasons. It's important for your fertilization of your flowers and also for keeping strength or keeping the crop to retain moisture.

Gene: Damian, you mentioned cooling but I imagine you may need some heating on these cool desert nights?

Damian: Yes, we actually have two different ways of heating the greenhouse. First, here is what we call the grow pipe. It's a movable pipe. We can move this pipe up and down in the crop to add heat and to make the microclimate acceptable up and down the canopy of the crop. Now, this pipe down here on the floor here is our fixed heating pipe. This is also used as our trolley system for all of our trolley carts and our picking carts. This is a fixed pipe it doesn't move up and down, but hot water still runs through it to heat the greenhouse.

Gene: So, Damian, what is the source of energy that you use to heat the hot water for these pipes?

Damian: Well, Gene, what we do is we have three industrial size boilers per site. So on this site we have three industrial boilers. We use natural gas as a fuel. A by-product of natural gas, of the combustion of natural gas is going to be water and CO₂. What we do is we will condense the water out of the exhaust leaving only the CO₂, which we pump into the greenhouse to enrich the greenhouse with CO₂ because the plants will use the CO₂ as part of their photosynthetic process to create sugars.

Gene: So, not only are controlling the environment, the air temperature, but you are enriching it with the CO₂ and I presume the benefits are a greater yield?

Damian: Correct. Greater yields and greater growth pattern. More uniformity in the greenhouse.

Gene: You were discussing about microclimate and the importance of plant growth with this grow pipe, can you tell a little bit more detail about that?

Damian: The grow pipe we use, like I said before, is on a moveable structure so we can move it up and down on the crop. The main objective for that is we can steer the plant in certain directions, in certain growth patterns the way that we want to. And we can do that by adding heat to either the top of the plant, to allow it to stretch a little bit more by adding heat to that area. For that microclimate, making it a little bit warmer, in that microzone, or down here adding heat to the tomatoes which will add warmth and quicken the ripening which in turn will become more generative because it is making the tomato come off quicker.

Gene: So, you can actually affect the plant, it's growth pattern, to have more fruit and less leaves or more leaves and less fruit?

Damian: Yes, basically, yes.

Gene: And do you do that all with environmental control, and warm temperatures in the microclimate?

Damian: Yes, we can do it all by controlling the climate in the greenhouse. But we have different tools to do that. And the grow pipe is just one, the cooling is another, but all of those climate controls are here for us to use as tools to manipulate the crop the way we want it to grow.

Gene: So, climate is very, very important and I guess control of the climate in an automated way becomes very important?

Damian: Exactly.

ARIZONA SERIES – GRAFTING

Damian: Ok here's an example of what the young inter-plant will look like as it comes from the propagator's greenhouse. What you see here is we use what we call a grafted seedling so we use a strong root stock that is resistant against certain types of diseases and we mate that with the variety that we want to use. What this does is this allows us to have a strong growing crop and it prolongs the growth habits of the crop especially in this extreme weather. And here just across from my finger here you can see the juncture from where the grafting is. That is where we mate the root stock to the variety that we're actually growing.

ARIZONA SERIES – INTERPLANTING

Damian: Here we have an example of an inter-plant greenhouse and what we do with inter-planting is we'll bring the young crop in next to the old crop. The reason we do that is so we can have continual production. The old crop what we'll do is we'll remove the growing head so the plant will no longer grow vertically but it will still mature and ripen the tomatoes that it has hanging on it. Once we pick that off then the young crop will take its place. At about the same time that the old crop is done picking the young crop will have grown up and reached ripening maturity so it'll have its 8 to 9 tomato vines ready to pick on it. Essentially what'll happen is this young crop will take the place of the old crop. That way we have 100% production all year round, no gaps, or what we like to call a 'green culture'.

ARIZONA SERIES – FINAL COMMENTS WITH DAMIAN

Gene: Damian, could you tell us what you think is your single greatest challenge to having a successful greenhouse tomato business?

Damian: Yeah, there's actually a toss-up between two things. The first is you have to know so much about the greenhouse. It's not just about how to manipulate the plant or how the plants grow. You have to know the heating system, you have to know the irrigation system. You have to know the ventilation system, the cooling system. So it's a total understanding and that takes a lot of time because there's a lot of information to know. So that takes quite a lot of time to get all that stuff perfected. Number two is just the fact that I'm an American and I work for a Dutch company. It's a big obstacle to overcome because you have to prove yourself double-time to them.

Gene: And in doing so what do you feel that you wish you knew more of when you arrived here? You know when you first began working? Or even now as you become a professional and good, and very good at what you do what do you wish you knew more about?

Damian: I wish I knew about the separate components of the greenhouse. There are several areas that I wish I knew more about and I'm working on learning more about.

Gene: Excellent. So it's a constant learning experience.

Damian: It's constant learning.

Gene: Now you have people that work for you. I don't know if you hire them or they are hired for you to work. What would you expect more of them in what they know? They come here. What would you like them to know more about? Is there any one single thing that is limiting?

Damian: Well I think it's the ability to work with people because they come from a different culture and they're working with people from a different culture so sometimes there's a culture clash there, where they have to break that barrier and also communication. A lot of them don't speak the same language so there's also a communication barrier that takes a lot of patience to show the people what you want them to do because you have to do a lot of hand signals.

Gene: I see. What about the growers like yourself, new people who come in? I don't know how often that happens but when they do, what is their original or initial limitations that you wish they came in with more knowledge of?

Damian: New growers like students coming from the university they would have to understand that they didn't learn anything in college when it comes to real-world commercial experience. I didn't know. I thought I knew it all when I was thrown in here. I was...you have to start from the bottom. You have to understand that in order to be able to run a greenhouse you have to know how to do the jobs of the greenhouse, you have to know how to do the twisting, the lowering, all the cultural jobs that you do for the crop and you need to get the nitty-gritty, and re-build vent motors, you have to rebuild irrigation motors because those are the things that you have to do.

Gene: Damian, to enhance our college programs in greenhouse crop productions what would you suggest we do? Where do we start? What can we do to improve the type of student who comes here to work for you?

Damian: I believe it's very important for the student to get hands on and practical experience so the number one, most valuable thing they can do is go out to greenhouse companies, to nurseries and say 'This is what I want to do. I need experience.' Ask for internships. Get that experience. One thing that sets our education system apart from say one from Europe, the UK or Holland is they require their students as part of their program to get so many hours of practical experience and it more or less equates to about sixteen to eighteen months of practical experience before they graduate. Those are the kinds of requirements that we need here as well.

Gene: Is there any specific area that you really see them as deficit, being a deficit in?

Damian: I believe a certain aspect or an actual specific part of it would be entomology because we deal with plants and bugs eat plants and it would be an asset for entomology to be a structural part of the program.

ARIZONA SERIES – CLOSING REMARKS

Gene: It's been a long day today, we started out, tried to get here about 7:00, but I guess we got here about 7:15 and the first thing they do is they run us up this 30 foot, huge water tower. And Kubota Sensei she was just right in there with all of us. We're not supposed to admit that, so don't tell anybody that we did this. But I wanted to thank everybody for all their great cooperation and support that we had today. And give them an opportunity to say something as well and then we'll thank our videographer too.

Gene: So Dr. Chieri Kubota could you say a few words about your efforts today?

Chieri: Well I was so busy just making sure to keep the people, actors, under the shade and that was big fun. I was doing that, yea, it was very fun.

Gene: That's very important.

Chieri: And then it was a great opportunity actually. I visited here so many times and then every time I come here it was a great learning opportunity. And then it was great. I would like to thank you especially Damian for participating and spending this time with us. It was great.

Gene: I would also like to mention that Damian was one of the first students to go through the University of Arizona Controlled Environment Program. He was one of the pioneers and one of our first students, I guess, to get into the real world of greenhouse tomato production. So we were really glad he was here today. He was a tremendous help. You want to say a few words before we hit the road?

Damian: Well, basically, I just want to say that I owe a lot to the University of Arizona and whenever they need my help I'm here to help them 100%.

Gene: And we'll vouch that he does do that for us. Now, if the videographer would take off her helmet and get her over here. And I'll get out of the way so that she can say a few words.

Lisa: Well, it's been a long day and oh I have to take off my hat? It looks nice?

Gene: So what did you think of Arizona and the bobcats and mountain lions?

Lisa: Well I went hiking yesterday. I dodged mountain lions, and I liked it. When I first came it was really depressing. I didn't like the desert and dead things, but now I like it and am embracing the frontier life of Tucson. Wow, I enjoy it now.

Gene: So when they make that job offer here for the University of Arizona will you be able to leave the University of Florida?

Lisa: Happily, I will leave all the water, lush environment and the grass and I'll embrace the ruggedness of the mountains.

