

## EP. 018 – Post Harvest Handling of Blackberry and Other Small Fruits with Penny Perkins-Veazie (9/28/2023)

### **[00:07] Aaron Cato**

Thanks for tuning into the Southern Fruit Cast. This podcast aims to cover the people, technology and latest developments in small fruit production in the southeast. I'm Dr. Aaron Cato, extension specialist for fruit and vegetable IPM at the University of Arkansas.

### **[00:21] Amanda McWhirt**

And I'm Dr. Amanda McWhirt, extension production specialist for fruits and vegetables, also at the University of Arkansas. All right. Welcome back to the Southern Fruit Cast. Today our guest is Dr. Penny Perkins Veazie. She's a professor of horticulture at North Carolina State University, where she leads research on post-harvest physiology and technology and works at the Plants for Human Health Institute, where her research focuses on storage methods to extend the shelf life of fruit crops. And she also studies ways to determine the role fruit and vegetables have in human health. She also works on food safety, quality and consumer appeal characteristics of fruit crops such as flavor, color, antioxidants and texture to make sure our growers have better quality produce for our high value markets. She's worked a lot with strawberries and cane berry crops in much of her work and that's why we brought her on to talk with us on the Southern Fruit Cast today and we're very pleased to have her. Thanks so much for joining us, Penny.

### **[01:22] Penny Perkins-Veazie**

Thanks so much for inviting me.

### **[01:25] Amanda McWhirt**

So let's go ahead and kick things off. You know, before we got on to the podcast, we were talking about some warm weather that we're having right now in late September. But we're really coming off our second consecutive summer of very hot and very dry weather here in Arkansas. And in fact, this year we had more than ten days where temperatures were above 100 degrees Fahrenheit and many days where they were really reaching the upper nineties. In other parts of the southeast, maybe you had different conditions. I heard from some people in Virginia that it was a lot cooler and wetter. But I know other issues or other parts of the Southeast have really had a lot of struggles with this warm temperatures and drought, particularly in the middle of the summer in July, when we're still really into the bulk of our blackberry harvest. And for us in particular in Arkansas, we did see that that heat did impact our fruit quality. So we want to kick things off by just asking, what is your advice on how to harvest blackberry fruit under these conditions?

### **[02:26] Penny Perkins-Veazie**

Yeah, great question. We struggled with this all the years I was in Oklahoma working on blackberries and really it comes down to, based on some night temperature work that we'll talk about a little later. But and I know that Dr. Fernandez has advised keeping a temperature below 77 degrees when picking, which means a really short interval in July. So basically what you want to do is go out and as close to sunrise as you can get and you're waiting to make sure that the dew, that any dew on the leaves has pretty well gone, and get out there very early and harvest and you really, you're going to be wrapping up harvest by

the time your air temperature is reaching 80, which depending on the day could be noon or it could be 10 a.m.. And that's really the best. Once you get past that point, you start to get bruising injuries just from touching the fruit. They're just so hot they bruise easily. And also you start to gain a lot of field heat in the berries and then you're going to have to try to remove that as quickly as possible.

**[03:29] Amanda McWhirt**

Yeah, no, those are some great comments. And I think that's you know, those temperature ranges can sometimes be really difficult for us in Arkansas, where you know, at 6 a.m., the temperature is 79. And so. And the dew hasn't burned off.

**[03:43] Penny Perkins-Veazie**

Yeah, exactly. Yeah, yeah. 6 a.m.. It's 80 degrees now. What do you do?

**[03:50] Amanda McWhirt**

And that's that's just the struggle that I think we're going to be dealing with in the Southeast with a lot of our fruit crops, especially as we have got more of these more difficult conditions. But I want to drill down a little bit more on okay, so recommended time to be picking is early as possible before the fruit heats up, but after the dew has burnt off. What about some more specifics as far as like picking directly into the clamshell, trying to keep the fruit in the shade once it's in the clamshell? Any, any advice there?

**[04:23] Penny Perkins-Veazie**

Here, at least in North Carolina, we still do a lot of east-west planning. So, I mean, your rows are north-south. So you're facing, your fruit are basically facing the east and the west. And that gives you a little bit of an advantage. So what you can do first of all, you want with blackberries, you've got to pick directly into the final container for fresh market. You can't mess around and thinking you're going to go sort them in the packing shed. They're just too fragile. So what you want to do is go directly into your final container, usually a clamshell, and then you want to try to either get them to a cooler environment right away, which can be challenging, or you can try and find some shade. And we used to say, put them under a tree. But with all the food safety issues that have happened, that's really not the best idea anymore because of birds. So now what we recommend here is to put them on the west side of the row, which is still in the shade. And, you know, you might be picking on the east side, but the west side is right behind you. So you can put them over there at least for a little bit and gain a little bit of time before you have to take a load to the packing house. And the other thing you can try doing is putting up a canopy, maybe a portable canopy somewhere at a close point so you can put your fruit under that as long as you have plenty of space under that canopy. So you don't have a buildup of heat up closing in on the sides, for instance, you want an open canopy. That's probably the best thing you can do to try, and I know some of these farms are a miles away from any kind of pack shed. So that's that's really the two easiest solutions to this. Now we have done what we've done in the past is we built a mobile cooler, a pack and cool system that uses a cool bot system and basically it's a trailer. And I've seen modifications of this where it's also been put on a golf cart or a small Kawasaki or something like that. Those are very useful too, because you can stack probably 16 trays of fruit on these things and start cooling them right away. And those are those are wonderful if you have the ability to do that and can use utilize people to get them back and forth for you. Those are about the only things I know of right now to really try and maximize your effectiveness for cooling in the field.

**[06:35] Aaron Cato**

Something you kind of get on to the next part of it. So once you get it harvested and you get into clamshells and maybe you have it in a spot in the shade or something like that, so what is the best way to handle it to maximize fruit quality of shelf life? So specifically thinking about ways to get heat out and things like that.

**[06:54] Penny Perkins-Veazie**

Sure. Well, if you're a larger operation, you probably already have a pretty good system set up. Blackberries are only going to be, you can cool them only two ways. One is air cooling or room cooling and the other is forced air cooling. And this is where we get into a little bit of the weeds. And most people, if they're a large grower, they're going to be using forced air cooling and forced air cooling basically pushes air through the berries to remove the heat. And it's done fairly quickly. And the idea is to get your temperature within those pallet load of fruit down to about two degrees C within about 4 hours. If you do room cooling, that same situation could take 12 hours. And of course, the longer you sit around with more berries, the more your chances of getting disease starting to build up in softer fruit. On top of that now, one of the this is where the weeds come into it. One of the problems has been that a red druplet or color reversion has become an issue in blackberry. And there's been a lot of head scratching as to what causes it. You know, you bring in a perfectly good looking black blackberry. You cool it down the next day, you come out, it's got red reversion. And so what's the deal? And one of the thoughts is, you know, I'm thinking there's multiple things that could lead to this. One of them might be bruising. That's not showing up until a day later. But the other one that's come up is what's going on with forced air cooling? Are we cooling too rapidly? And there is such a thing as having too big a fan speed and in forced air cooling and usually we see that as drying out. And in this case, the we're beginning to wonder, tossed this idea around a lot, is there micro membrane damage going on where we're actually getting multiple tiny little freezing or chilling events on the membranes when we're forced air cooling so coldly? And this is one of the questions that's come up. Okay, so what do we do about this? Do we do we back off? Do we wait on room cooling because of some of the some data out there that indicates if you hold your fruit a little bit warmer for a short period of time, maybe you won't get the color reversion. So that leads into something called stepwise cooling, which is a fairly new thing. I've never heard of it before for small fruits, actually. Usually when small fruits like get the heat out, get the heat out, get as close to zero degrees C as you can, or 32 degrees, but stepwise cooling is done with stone fruit a lot, and the idea is to try and prevent problems with peaches. In particular, nectarines are very sensitive to getting browning inside or cold injury. And if we're assuming the blackberries are getting cold injury somehow through forced air cooling, then the alternative suggestion would be to either delay cooling your blackberries or do a lower force their cooling temperature. And I would say, yeah, so you could delay cooling and then do forced air cooling or you could do forced air cooling, but go to, instead of trying to get to two degrees C, maybe you want to go to five degrees C or 41 degrees Fahrenheit and then finish the cooling process in the room. So that would be one way of looking at stepwise cooling situation for, for commercial grower. Now, if you're a small grower, it's a little bit, you have fewer alternatives. So small grower, you got one small cooler and you have to make sure you don't have too much in that cooler because you need a little bit of space around those blackberries to get the heat moving out with room cooling. The best thing you can do is have a fan or two and in a room cooling that you're trying to move the air through the blackberries as quickly as possible. You can actually kind of make a modified forced air system by putting a fan at one end, you set your fruit trays up, your trays of clamshells, up one on one side and one on the other side of the fan and put a tarp over

the top of the clamshells and the fan is going to help, it's a tunnel effect that's going to help dry that cold air through the fruit. So that's kind of the scale of systems. There's not a whole lot to talk about when it comes to cooling blackberries because you only have two options.

**[11:00] Aaron Cato**

Yeah. So kind of following up on what Amanda said or talked about before in some areas of the southeast, you know, you start out the day almost at a spot where it's just too hot. And then a lot of those areas as well, they have maybe labor issues where they're not going to be able to pick all the berries they have a lot of times because some people get just a bit too ambitious with the number of berries they have to be picked. And so if you're starting out with hotter berries, than may be a lot of has been looked at in the past. Would you change the recommendations and also say you're picking at 90 degrees? Do you change the recommendations to maybe try to help reduce as much damage as possible?

**[11:38] Penny Perkins-Veazie**

Yeah. Now you're in a sticky wicket here, right? Because now you're at the point where you could be bruising just by picking. You've got, you still got to get your food crops out of the field or you have a disaster going. And so what do you do? I mean, my first thought is bringing giant fans to move the air, but that's still not going to you know, it's still not going to give you more than a few degrees of cooling. So at that point, you're kind of stuck. I think if you can get some sort of cooling system in the field, like a cool bot system that's ideal. So you can start that process right away. And so basically what you're doing, you know, you might be bruising the fruit when you pick it, no matter how gentle you are, when you pick it up at the plant. But maybe by getting it cooled rapidly, you minimize that membrane damage before it builds up from the bruise. So then it's like, okay, double wham. Quick, quick, quick, quick, quick. You know, get a load in. Get somebody. If your pack shed or cooling system is fairly close, you're driving back and forth, back and forth, back and forth through the small vehicle. If that's possible. If it's not possible, then consider putting in some sort of modified trailer. I've seen people bring in Refrigerated Box trucks, refrigeration on those is not great, but it's better than sitting in the field for any amount of time. I mean, really, you're looking you're trying to get these things cooling it 90 degrees temperature. You're trying to get them to cooling really within 15 minutes of harvest when you're when you're talking about this otherwise. And even then, you still have to be careful. If you knew you had a hot day, you better mark these guys as being the first out of the door to a retailer because they just won't last as long as something that was picked at 60 degrees Fahrenheit.

**[13:18] Aaron Cato**

Yeah, that's some good advice and kind of thinking on the other side of the scale, we have a lot of growers that are picking the morning to sell Fresh Market that day with our farmers markets or people coming on to their on their operation to buy them just straight from home. So do you do you think callings necessary if you're going to sell it in the next couple of hours? I've seen some really good blackberries sold at farmer's markets that have zero red drupe and they said, I picked them that morning. Do you need a step of cooling between then if you expect to sell them or is it fine to just go straight warm?

**[13:50] Penny Perkins-Veazie**

Yeah, if you expect to sell them. I mean, the whole point is to get them off your hands before the red drupe shows up. So you pick them this morning, they look great and somebody takes them home. The

next day they're going to pull them out of the refrigerator and go, that's funny, they're turning red, but they're not going to think that it has anything. They're going to assume they're refrigerator, first of all, I'm not saying that, it's a, it's a game you're playing, but really, you don't have an option if you're if you're picking to sell that they go ahead and just do it. Don't worry about the cooling issues unless you just know that you're going to be sitting around for 10 hours at a warm temperature and you need something to keep them looking good. But other than that, no, I would say just go direct as quickly as you can. And if they look good, that's great.

**[14:33] Amanda McWhirt**

You know and I had a thought, Penny, that I think the three of us have seen a lot of blackberries and picked a lot blackberries. So we probably know what some of these disorders look like. But some of our listeners may not know what bruising on a blackberry looks like or what some of the red druplet reversion things look like. Can you describe for us what, what those when you say bruising on a blackberry, what does that look like?

**[14:58] Penny Perkins-Veazie**

All right. Let me back up a little bit. So it used to be when we picked blackberries back in the day when there wasn't a good retail market system. What you mostly worried about with blackberries was mold. Gray mold is a real easy one to see. Everybody knows what a fuzzy, fuzzy fruit tends to look like. But scale forward 30 years and now we have cooling systems and really high quality firm fruit. So the color reversion and the bruising, so bruising and heat stress many times expresses a little bit differently. It will look kind of like a maroon berry and it will show up, usually you'll see it the next morning and it's different. Color reversion, on the other hand, tends to be like a druplet. So let me also describe what throughputs are in blackberries, you have these tiny little fruitless together. You know, they're bumpy looking and each one of those bumps is a druplet. And what happens with color reversion is you have three of those turn red or more. It's now considered to have color reversion. And nobody cared about color reversion in the early days of blackberries. But as you have more and more competition in the market, it's being used as a way to reduce prices by by the distributors to the growers. So now it's become and it's also become a grading standard so the two are different. The bruising effect is going to look more like an overall maroon color of your berry and why do I say maroon and not bright red? Because bright red means your berries under ripe. Color reversion, on the other hand, you'll have these individual druplets that will turn a red color, and it's usually anywhere from a slightly bright red to kind of a maybe a darker red is just not black anymore. And sometimes you never really notice because they are, you know, maybe you said, well, they look black, but now I'm getting these red dots. What are they? And color reversion is really it's a loss of anthocyanin, it's a loss of the pigment inside that individual bump, that druplet. And what happens when you lose that anthocyanins, what's left has a lower pH, so it expresses what color is left becomes a red color. It doesn't affect the flavor at all. It's simply a cosmetic issue, and it doesn't affect the firmness either. It's just one of those irritating things that growers have to deal with if you're trying to sell commercially.

**[17:20] Amanda McWhirt**

Perfect. Thank you so much for clarifying that for us. Well, let's circle back around. We kind of started talking about we have these really high temperatures. We have some constraints in that we are trying to pick fruit before it gets too hot during the day. You know, you've done some work that I think is really interesting and trying to figure out some novel solutions to this issue of, you know, the coolest part of

the day for us is generally at night. And so can you tell us a little bit about some of the research you've done looking at doing night harvest of blackberries?

**[17:54] Penny Perkins-Veazie**

Sure. There is a study I was looking to set up. I forgotten all about the study back in 2017, you know, pre-COVID. And so I was looking at this. Yeah. So Dr. Fernandez and I got together with a grower down in the southern part of North Carolina, near South Mountain. And what she did was arrange to to put wetness meters on the berries, on the leaves mostly, and put up sensors all around the farm. And they spent all day from like 9 a.m. to the following 9 a.m. at the farm. And every 3 hours they would have people go out and harvest berries and we're talking a lot of clamshells. And then they brought them back in a refrigerator truck to us at Kannapolis, and we evaluated them, evaluated them. So what was happening is what was going on here is like, okay, now we're having the same problem in 2016 when we had that heat bump where, where we had these really, really warm temperatures. And and is this a solution to do night harvest? But we saw, of all the days we chose, that was probably the worst one because it was a relatively cool day. It only got up to in the eighties, the night temperatures went down into the I believe it was into the sixties. And so what we saw was that the coolest time of the night or the day the hottest time of the day was at noon. And because this is June and not July and July it's 3 p.m., and then the coolest time of the night was right around 3 a.m.. And what we were seeing was that the fruit were getting dew or it wasn't on the fruit themselves weren't getting dew, but the leaves were getting dew around 3 a.m.. Let me check my notes here to refresh my memory. So the best time, though, to harvest these fruit turned out to be after sunset. So essentially around 9 p.m. to midnight was the best time to harvest the fruit. This is when the temperatures basically reached the lowest point before dew forms. And then the worst time by far was 3 p.m. to 6 p.m.. So that kind of underscored what we had already figured out over the years that you shouldn't be harvesting berries in the late afternoon if you can possibly help it. But what we were finding was that also the dew issue came up. Of course, that was very important for us to find. It's like, okay, we're not going to dew in the berries, but we are in the leaves. So if we go down to harvest here early in the morning, like around 6 a.m., we're actually going to be getting our berries wet, even though the berries are warm and they're not getting the dew forming. And then of course, that's a negative because you don't want wet berries. The other thing that was interesting, of course, from my point of view as a physiology person, was that what was going on inside the fruit and the organic acids were shifting quite a bit. And so what we saw is that the organic acids reach a high point at 6 p.m. and then they go the lowest at midnight. But our sugars themselves didn't change much. And the reason for that is organic acids seem to be what's used as the source for respiration in blackberries, which is a little unusual. It's usually not the way it works. Usually it's using sugars and converting them. But but blackberries and small fruit seems to work the other way. So anyway, the takeaway here is that what we want to make sure of is that, yes, you can do night harvest, but you need to be careful when you do it. Basically, you're restricting yourself. It's between sunset and midnight, probably. So a three hour window is best in order to get the maximum benefit from this.

**[21:39] Aaron Cato**

How quickly did the like the surface area of those berries drop once the sun went down? Or I guess when the sun started to go down.

**[21:45] Penny Perkins-Veazie**

It mirrored, the temperature of the berries, mirrored the air temperature very, very, very closely. I mean, it was maybe three degrees difference between them. So let me say at that point in time, in June, like I

said this, you know, it had so many hot days. What do I get the one cool day? But at that time, I believe the temperature drops in June. It drops pretty quickly here at sunset, it was dropping probably five degrees an hour. Okay. So it was like what was the differential in temperature? Yeah, it was it. I had this somewhere in my notes, looking at this. Yeah, it's 51 degrees between midnight and 3 a.m. and then 88 degrees at noon. So 30 degree difference over the day and we'd consider 51 pretty cool here. So at 6 p.m., it would have probably been down to about 70 degrees.

**[22:45] Aaron Cato**

And that's interesting because, you know, we a lot of times with pesticide applications, we always tell people don't spray them later in the day, especially if you're worried about any kind of burning because the surface temperature of the plants tends to be highest that time of the day. So I didn't know how, if the berries were getting really are a lot hotter than the air temperature and then coming down or what. But yeah, that's really interesting.

**[23:09] Penny Perkins-Veazie**

Yeah, yeah. I mean, it's good to know that. I mean, because berries are they have a black surface. So you're thinking, okay, they and I did seem to hold a little bit of heat enough so I didn't get dew formation. And that was the other thing you know, our dew point was unusually low, probably because there was drier, our air humidity, which just wasn't as high.

**[23:26] Aaron Cato**

Yeah. Where we I mean, even in like Arkansas, where we have heavy humidity, it's still around that time where people can't harvest like say row crops, they'll harvest into the night. But once you get past midnight, now getting close to one or even three, it's you're going to have a dew set in by the end. And sometimes when the dew points, you know, pretty bad. So kind of like in the same vein could you follow up a little bit more about the effects of day and nighttime temperatures and their impact on fruit ripening? Because, you know, we think about that a lot because during these heat waves, we also have these huge shifts in our nighttime temperatures. And I know for we woke up a few more mornings to go to work and it's been 83 degrees and so I mean, it gets pretty high at night and in the mornings.

**[24:13] Penny Perkins-Veazie**

Yeah, I remember that as back in 2000 when you know, 6:30 I'd be getting ready to drive to work and southern Oklahoma was 88 degrees already. Yeah. Yeah. So, you know, unfortunately, it's, it's it's it's kind of strange because normally we always associate with more rapid ripening as is your day and nighttime temperatures increase especially in nighttime temperature. You know that's why our fruit would ripen, sometimes you can walk to the end of the row and turn around and they're ripe again. I sweat it feels like that some days. And so as soon as your especially your nighttime temperatures start going up over 70 degrees, you, I would think you can probably figure you can cut a day in ripening time right there. And which literally does mean that probably every two days or in these heat spells, you might be getting fruit that are ripening rapidly. The bad side of this, though, I think was illustrated by the heat dome that happened in the Pacific Northwest and Canada a couple of years ago. But what happened there was is so hot, it was 120 that in a day and 95 at night, 95. Wow. And so what happens when you have that is it stresses the plants so much that you know, you're not getting enough water to keep up with transpiration and respiration. And so what happens is that when the fruit start to shut down, they won't ripen properly. And you don't get pigment development and you don't get the normal cell wall softening. So you end up with a conundrum. And I don't know if you all saw that this year where for whatever

reason, your blackberries don't look right. You know, they don't have the right color. That might be a little red colored. They don't feel right. They're not swelling the way they should be. And these are all you know, this is something we're all worried about. I think going forward as we get more and more these extreme weather events that we have to be on the lookout for and figure out what we can do. But there's no way you can keep enough water on those plants. I don't think even a misting system could combat 120 degrees, especially and especially at night and 95.

**[26:12] Aaron Cato**

Yeah, I'm glad you talked about that side of it because I'm an entomologist and we always talk about insects being a function of heat. But what a lot of people don't understand is there's a top to that. I mean, there's a top end of their growth and they will slow down or die when it gets too hot. So it's interesting on the plant side to see the same with fruit ripening. It's something I probably haven't thought about. I know it always seems funky to us, Amanda, when we're trying to we have a lot of questions about I have green berries, how long until harvest or are people trying to gauge their labor and that kind of thing? And then we get what was it, the two years ago, Amanda, where we got it was in our late May, I think, or early June, where we were in the upper nineties. Just like consistently, I think it really, really affected strawberry season, but it also made the blackberries come off weirdly, right?

**[27:00] Amanda McWhirt**

Yeah. Yeah, it's every year it's kind of a guessing game of how how things are going to progress with the weather. And yeah, you just never know. So I appreciate your comments and particularly, you know, in these comments about the temperature being above 95 and the fruit ripening in a weird way, because I do think that we have seen some of that and it's always maybe even a guessing game there as well as. All right, there's some weird blackberries. What's the cause? You know, is it temperature? Is it pollination? Is it, what's going on? But yeah, I think temperatures is more and more becoming something that we need to be thinking about contributing to a lot of these things.

**[27:40] Penny Perkins-Veazie**

Yeah, I will say, you know, in Arkansas, you can almost put it down to the day usually with blackberries when they, you know, from the time they they stop their blooms, their petals fill up to the time they'd be ripe was right around 30 days, but somewhat sometimes it'd be 26 days and sometimes it be closer to 40 days. So for anybody who's not experienced in that, that's that's what you're looking at. You know, I'm sure somebody has probably got at least one model out there. That's I mean, it's not like we worry about growing degree days for blackberries usually, but you can pretty much gauge, you know, that you're going to have a window of opportunity. You're looking to. You better be ready. In other words, to pick 30 days from when they when you start to see the petals falling, be prepared and then you might have to back it up a little bit.

**[28:25] Amanda McWhirt**

That's great advice. All right, Penny, I think we're going to wrap it up with one final question. We just want to hear about what other exciting berry and human health research you have going on there.

**[28:38] Penny Perkins-Veazie**

So right now, the berry world, a couple oddball things that have come up. One is on elderberries. So American, there's Missouri University, Missouri is spearheading a big USDA grant, funded USDA grant to look at American Elderberry, which is kind of been the ignored native crop for many, many years. It grows all over the United States. There's a ton of elderberry research that's gone on but is with European



elderberry. And so the thrust of this work is to look at how American Elderberries work and help. There's already some interesting stuff published and American Elderberries by the way, do differ from the European elderberry in their in their patterns or phenolic and in the sciences. And then I think in a very positive way, they have some differences that could be extremely useful for human health. The other thing I'm working on, I have a master's student who's working on this is on strawberries, and this is where to start. A more of a practical question, which is can we, strawberries come in different colors, right? We've seen the pearl strawberry, which is like a light pink color. And then we've seeing material. And Dr. Fernandez's program that I say is almost black. It's such a like a purple-black color and so I was very curious to find out what's making these colors different. And the obvious answer, of course, is the total amount of pigment in the strawberries and the pigments and strawberries are pretty simple. There's only four major anthocyanins involved. So we've been looking at how that color relates to the anthocyanin profile. The most interesting thing that's come out of this, as I was looking this up last night, was that there is a paper published in the Proceedings of the National Academy of Science in 2022. They're using pelargonidin which that the major pigment in strawberry. Now what they're refining is they're using a mouse model. They found that the intestinal epithelia became permeable to proteins when they were given pelargonidin. And now why would you say you would care? Well, it turns out that they're very interested in delivery methods that do not require needles, specifically insulin for diabetics. So if you could give somebody insulin orally and they would they would be able to absorb it. That would be a huge, huge shift. And it's really exciting to me to find out that here's a little old pelargonidin that we just found a lot and strawberries would happen to be a key player in all of this activity. And that's really where we are right now.

**[31:00] Amanda McWhirt**

That's fascinating. Penny, how cool? Well, very cool. Well, thank you so much for sharing some updates on your work and we will definitely be staying tuned to learn more as you as you progress, particularly with we hear a lot of interest in Elderberry here in Arkansas just with the big industry in Missouri. And so we'll definitely keep an eye on what you all are working on.

**[31:25] Aaron Cato**

Yeah, I think some of the varieties, the cultivated varieties are from North Arkansas, from Paragould I believe.

**[31:31] Penny Perkins-Veazie**

Yeah, yeah. I've been, I mean there has been fascinating. We worked on these, you know, Wildwood and Gorda and I was working on those when I was in Oklahoma. And Pocahontas, which is a humongous elderberry. Yeah, it's been tried in North Carolina. Does very well here, too, so we're excited.

**[31:48] Aaron Cato**

Yeah. Thanks again for coming on, Penny.

**[31:51] Penny Perkins-Veazie**

Yes, it was great. Thanks so much for having me.

**[31:56] Aaron Cato**

Thanks for tuning in to the Southern Fruit Cast. Our episodes are hosted by Buzz Sprout and can be found on the University of Arkansas Extension website at [uaex.uada.edu/southernfruitcast](http://uaex.uada.edu/southernfruitcast) here you can see all of our episodes and provide us feedback to help shape future episodes of this podcast.

**[32:13] Amanda McWhirt**

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