Sustainable Horticulture: Exploring Biodegradable Mulch with Dr. Carol Miles

(00:00:00) Nataliya Shcherbatyuk
Hello and welcome to the Mulch Matters Podcast where we will explore the intriguing world of mulch and its impact on agriculture and the environment, as well as update you on the latest research about soil-biodegradable mulch and recycling options for plastic mulch. I am your host, Dr. Nataliya Shcherbatyuk, and I am a communications specialist for the project, “Improving end-of-life management of plastic mulch in strawberry system”. In each episode, we’ll dive into the latest research, trends, news, and insights on why mulch matters and how we can improve plastic mulch end-of-life options. We'll also branch out and discuss other plastics as well as talk to researchers, experts, and practitioners in the field who will share their insights and experiences on how to use mulch effectively in different settings.

(00:01:04) Nataliya Shcherbatyuk

I would like to welcome Dr Carol Miles to our podcast. Carol is a vegetable extension specialist at Washington State University and director of Mount Vernon Northwestern Washington Research and Extension Center. Carol also plays a huge role in our project: ***the end-of-life options for plastic mulch in the strawberry system***, as she leads the extension and outreach working group. Carol is guiding the team on writing and creating new outreach documents based on the new research carried out by project members. This is an extremely important part of the information delivery, and I will let Carol talk more about it. Thank you so much, Carol, for joining us today and let's dive in.

(00:01:58) Carol Miles

Thank you so much for inviting me.

(00:02:01) Nataliya Shcherbatyuk

Would you mind telling a little bit more to our listeners about your background and actually what brought you to horticulture.

(00:02:11) Carol Miles

Yeah, so I'm the vegetable extension specialist for Washington State. I've been at Washington State University for almost 30 years, so this is my 29th year. I came, this is

actually my first position after graduating. So completed my PhD in vegetable science at Cornell University and came here. Came here for 3 years and here we are, almost thirty years later. It's a wonderful job that I have. I work with vegetables, I do variety trials, I specialize in new crops - alternative crops. So, I work with crops that are not commonly known in the United States, they're not new in the sense that somebody didn't just make them. They were just new to us so new to Americans, new to Washington, and my entire career has been based on just looking at new crops, new cropping systems, and I have just always had a great admiration, I want to say, for vegetable crops just because they play such a big role in the human diet, and in general, I find that they are overlooked. They're not given a lot of attention certainly when you look at the research and the funding that goes into agricultural production, it tends to be more with large commodity crops, grains, carbohydrates, if you will, and the vegetable crops that really underpin human nutrition and well-being don't get a lot of attention. And so, I was drawn to vegetable production very early in my life, I did not grow up in the United States, I grew up, my father was a US diplomat, and we grew up, we lived many years and in many different countries, but they were all relatively poor. And everybody grew their own food and it was really evident how important food production was to human life, safety, wellbeing, and vegetables just being such an important component of the diet, you know - minerals, nutrition, protein. So, when I went into graduate school, it just was a natural migration for me to move into vegetable crops, just because I saw such a great need and very few people addressing it.

(00:04:18) Nataliya Shcherbatyuk

That is so true, that is, when I came to the United States, it was very interesting that vegetables are not a priority, what I've learned immediately. It was a little bit shocking. So, I'm glad to hear that you are working with vegetables.

(00:04:37) Carol Miles

Well, if you don't mind, I'll just share a little statistic that I heard many many years ago at a conference, but the average American diet includes 4 vegetables a week and one of those is potatoes, whereas the average Chinese diet includes 40 vegetables a week and none of those are potatoes.

(00:04:53) Nataliya Shcherbatyuk

Yeah, this is so true. I was doing my groceries and I got beets and cabbages, different types of cruciferous, and actually the guy who was on the cash machine, he asked: "What

do you do with all of that? What do you do with beats? You probably juice a lot." I was like no, I just cook them and eat them. Yeah, that's very interesting. Well, now moving more into the mulch world, can we dive more into your history with biodegradable mulch research and what is your role in this project?

(00:05:34) Carol Miles

Yeah, so looking at the history question, I started working, again, you know, came to Washington State University almost thirty years ago and immediately started working in organic production systems. And looking at organic production systems, one of the major ways to control weeds in vegetable production is with plastic mulch. And thinking about organic production and the plastic waste that was being generated on an annual basis, and those production systems to me just didn't seem to align well. So, I started to look for alternatives to the polyethylene plastic mulch that is used traditionally throughout American farming systems. And about, so going back into 2000's, so, 20-23 years ago, I came across a product that was being used in Europe, which was a biodegradable plastic and so I started to do trials about 22 years ago, looking at alternatives to plastic, so, looking at biodegradable mulches. Looked at paper mulches and then biodegradable plastic that was being produced in Europe for farming systems there and started to do trials here in Washington with the vegetable crops that I was working on. So, that's what brought me to biodegradable plastic mulches. And then my role on the project: so, my role on the project on this project is to work more with an extension outreach team. So, I guess I'll just take another step back and say that, you know, so, working with biodegradable plastics for the last twenty-two years I've been involved in 5 different SCRI grants. So, I was part of the initial team at Washington State University back in 2008 that submitted our first SCRI Specialty Crop Research Initiative proposal. Debbie Inglis was the lead, and I was the co-lead on that and so we had a planning grant, and then had our first large grant, and then formulated a national team, and then when we submitted our third SCRI Grant, Tennessee, the University of Tennessee researchers took the lead, because, honestly, after 5 years of leading a SCRI grant, it was exhausting and so, we passed it on to Tennessee, and then that project went for 5 years, and then it came back to Washington State University with Lisa Deveter being the lead and Markus [Flury] being the co-lead. And as director I just, you know, I'm not able to take a leadership role anymore. I just, I have a full-time job as being director at the research center and so I felt that a good position for me on this new grant project was taking a leading role in the extension and outreach. It's something I've done, again, my entire career as an extension specialist. Getting information out, getting research information out to various stakeholder groups in such a way that hopefully it's understandable and can be used by growers, could be used by legislators in different venues to convey the information that as research scientists are very good at generating research articles and that's you know, what a lot of

us do, but get that information written in such a way that that growers and legislators can read it and understand it, and can make some decisions, you know, as to what to do with the information. I think that's a different skill set and so that's the role I take on the project.

(00:09:01) Nataliya Shcherbatyuk

Yeah, that's quite important. And you mentioned bio-based mulches an.d your experience. Would you mind explaining to us what biodegradable mulch is and what bio-based mulch is. And what is the biggest confusion between these 2 terms.

(00:09:20) Carol Miles

Yeah, so a biodegradable mulch is a mulch product that is going to biodegrade. So, “bio” means with natural organisms, I'm going to say, as opposed to “degrade” which would be more of a chemical process. So, there's degradable and biodegradable. So biodegradable is going to be degraded through mechanisms of biological systems. So that's biodegradable and there are biodegradable plastics. So, plastics are formulated with many different polymers and there are biobased polymers that are used to make biodegradable plastics. But bio based and biodegradable are not equivalent. So, a bio-based mulch or a plastic is made partially with a polymer that is generated from plant material and that plant material oftentimes is going to be starch or starch generated from let's say corn. I'm trying to think all the different feedstocks that go into those polymers, a lot of them aren't produced in the United States, so sugar cane, beets, you know, just their waste product. You can imagine extracting sugar from sugar cane, and you end up with all this plant material that otherwise might just be a waste product. Well, you can ferment that, or you can process it in different ways. And one of the ways that you can process it is to make a bio-based polymer that is then incorporated into a biodegradable plastic. But the bio-based polymer does not necessarily make that product biodegradable. Those are two very different actions, if you will, so, it's the polymer structure that allows the action of the microbial populations, or temperature, or moisture to break apart the plastic. It's a polymer structure and, as I always like to think of, you know, carbon is carbon. So carbon coming from a plant versus carbon coming from a Fossil Fuel is still carbon, there's no difference. It's the polymer in where that carbon is used that makes a difference of whether or not a product is biodegradable.

(00:11:40) Nataliya Shcherbatyuk

That is great! I've met I met a few confusions that I heard about bio-based and biodegradable. So, I thought I'll definitely ask you these questions. Can you share some of the biggest myths that you've heard about biodegradable versus bio-based mulch?

(00:12:00) Carol Miles

Well, I think you just nailed it with your first, your previous question there which is bio-based. And the first myth is that *in order to be 100% biodegradable, a product has to be 100% bio-based* and that is a pure absolute myth. So again, it's not the biobased content that makes a product biodegradable. It's the polymer, it's the carbon structure, it's the bonding the carbon, you know, whether or not it's a single bond, a double bond, whatever, you know, whatever that structure is, that's what makes the product biodegradable, not the bio-based content. So, that's the single greatest myth that I hear all the time.

(00:12:36) Nataliya Shcherbatyuk

Exactly! So, when we speak about biodegradable mulch, we don't really mean it's completely bio-based and that's quite important for the audience to understand this.

(00:12:47) Carol Miles

Yeah, and I think you know just putting that into perspective the biodegradable plastics that are in the market today. So, if you go to a grocery store and you buy your produce and you're putting it into a biodegradable bag, for example, plastic is made at the most probably with 20% biobased content. Because that's the maximum amount that can be used with current technologies and methodologies to create that plastic film that you know you need to have to create a bag that's going to hold up to putting your apples in the bag. You know, it's got to take a certain amount of weight, and pressure, and so. That whole process of actually making that plastic with all these different ingredients currently with current technologies, it's about 20% bio-based, it's the maximum, so something to keep in mind, I guess.

(00:13:36) Nataliya Shcherbatyuk

Right! And you bring up another quite important point: just because it says 20% bio-based it doesn't mean that it's equal to 20% biodegradation.

(00:13:47) Carol Miles

Absolutely not. So, in order to be labeled “biodegradable” by regulations a product has to go through testing, and that testing determines whether or not it's actually 100 % biodegradable. So, in order to be labeled biodegradable, some states require those tests to be shown before a product can go on the market as labeled biodegradable, they have to actually show that the product is truly 100 % biodegradable. So, I would say that if anybody has any questions about whether or not their plastic product is biodegradable, they should be looking for those tests, and I personally think consumers and states should be demanding that those tests are carried out because there are a lot of products that are put into the marketplace that claim to be one thing and they're not. And I think we all know that in various walks of life these things happen, and it certainly happens with biodegradable plastics.

(00:14:40) Nataliya Shcherbatyuk

Yeah, that's quite important for people to pay attention and be careful especially when you read the labels or instructions, or any details about the products. And moving back to the mulches, so, let's say that some of our listeners today are really interested in switching from the use of traditional plastic mulches to biodegradable, what would be your main tips and tricks to point them out before they actually do this switch?

(00:15:12) Carol Miles

Well, I think what most, and I guess I'm going to talk to commercial growers at this point, you know if you're a commercial operation and you have commercial equipment that's laying plastic you know, using large scale equipment, the thing to know is that you can use that large scale equipment for a biodegradable mulch just as you use it for the traditional polyethylene mulch, so you do not need any new equipment, but you do have to make some adjustments, you just you know you raise, your wheels that are putting the mulch onto the bed, you raise them a little bit, so they're not pressing down as hard. You loosen up your wheels and in the layer itself there are various wheels and rollers, and you just want to release the tension. So. It's not so tight because the by tangible plastic, it's going to rip quicker than a polyethylene plastic. So that's probably the 1 thing you really have to think about is you just have to release the tension on your laying equipment. So that's just not quite as tight. But once you do that, you just use your normal equipment and normal rate, driving rate, and you can lay your biodegradable plastic just as easily as polyethylene plastic. And then the next big thing that we've been hearing more about in terms of commercial production is knowing what your next crop is, following your crop, assuming you're in a crop rotation plan so that, but again, sorry I'm going to take a step

back understanding that the purpose of a biodegradable mulch the way that it works for growers and saves growers money, is that at the end of the cropping season you till it in, so it's just tilled right into the soil and it biodegrades in the soil system and that's what your labels and standards do is they test the product to make sure that that's indeed what happens. So first off, you have to buy a product that is labeled as being tested to biodegrade in soil systems. That's your number 1 criteria, so then when you go to do that you're going to end up with plastic pieces fragments they're biodegradable but they're going to be certainly right after you till them in they're going to be on the soil surface and in your soil, so you want to make sure that the next crop that you come in with that's not going to be a problem. So for example, if you're growing, let's just say a baby leaf spinach crop as an example, where you go and you mechanically cut the crop and it is a very short timeline from planting to harvest, then there may be an opportunity for some of that plastic that's on the surface or close to the surface to be picked up by your harvester, so understanding what your cropping system is and making sure that you don't follow a till down with a crop where you're going to be mechanically harvesting the whole crop at the soil surface. I think that would be the biggest lesson, I think we've learned in the last five-ten years.

(00:18:02) Nataliya Shcherbatyuk

Yeah, I'm thinking about pieces of mulch in spring mix salad. So, it's quite important to think a step ahead.

(00:18:12) Carol Miles

So yeah, crop rotation. If you're following with, you know, a pumpkin crop, let's just say, or a corn crop, or something like that, then you have no problems at all because your harvestable product is above the soil surface. It's just not an issue.

(00:18:25) Nataliya Shcherbatyuk

Right! That's quite interesting point and as a vegetable specialist I'm sure you worked with numerous and very diverse vegetables and that's what you mentioned in the beginning, but do you have your favorite vegetable? And I know this question can be a torture, just what's your favorite vegetable, but you know, if you do have your favorite vegetable, would you tell why is it so special and not only about growing that vegetable but also for consumption purposes.

(00:19:05) Carol Miles

So, It is a really really hard question just you know so for the listeners to this podcast, I've worked with a lot of really wonderful crops in my career, you know, from edamame to wasabi, to peanuts, to baby corn, to melons, eggplant, I mean, I've had just a wonderful bulb fennel goodness. a lot of diversity and the crops that I've worked with, but, and I don't know if we're going to classify this as a vegetable, so I'm going to call it my favorite plant crop is going to be dry beans. And I worked with dry beans for many years, I worked with dry beans here in the United States looking at niche market colored pattern beans. So getting away you know, not the commodity pintos and navies, but the calypso and the orcas orca was actually a bean that came out of the Washington State university program, actually USDA there in Prosser, and I tested it as a breeding line in my program, and we released it, and the breeders called it Orca for Western Washington, so it's a black and white bean. But dry beans, I'm going to say are probably my favorite crop overall just because they can be eaten, and working in Africa and the farming systems, I worked with there, they eat the leaves as a vegetable, they eat the green pods as a vegetable, they eat the fresh shell bean as a vegetable, and fresh shell beans are eaten throughout Europe as well seasonally. So, cassoulets, you know, from Spain, France, Portugal, Italy, you know, just an important fall crop made from the fresh shell beans and then of course you have the dry bean itself. So, if I look at the spectrum of all the different ways that you can eat a bean, a common *Beingan Phasiois Voulgaris,* sorry for anybody not wanting the Latin name there, but a common being driving all the different ways you can eat it and the fact that it plays such an important role in the human diet and so it plays a big role in the United States when you look at diabetes. So, you know it's just such an important part of diet overall and can really work gotchas play such an important function in the United States and the health issues that we have in the United States when you consider the high rates of diabetes we have because we don't have plant protein in our diet. I think is probably the underlying cause there and I think for your listeners just to understand that the majority of the world gets their protein from plants not from animals or you know animal protein but from plant protein and so dry beans are just such an important crop worldwide, but in the United States they really could play a much greater role in and our health issues and solve a lot of problems that can just naturally be solved by changing what we eat.

(00:21:49) Nataliya Shcherbatyuk

Yeah, that's great. You brought up human nutrition. It's my other passion. It's the plant-based human nutrition and beans are literally on the first place about it, because it's not only protein which is extremely important, but also fiber from beans.

(00:22:04) Carol Miles

Yeah, exactly, so, you know, I like to, I have to say I have a pressure cooker for my beans and, you know, I always have a pot of beans in the fridge and, you know, add a couple of spoonful to your soup, whatever it is that you're making, it's just such a good food.

(00:22:22) Nataliya Shcherbatyuk

Yeah, absolutely I just had my set cooked yesterday also in the pressure cooker, so that beans - beans.

(00:22:32) Carol Miles

That's right.

(00:22:33) Nataliya Shcherbatyuk

Thank you so much, Carol, I think that was fantastic and quite educational for our audience.

(00:22:40) Carol Miles

Well, thank you again for having me. It's you know, working with biodegradable plastics is it's become an career defining project for me as I again reflect back how long I've been working on it and the amount of work we've done So, I think that as a society we really have to consider our consumer choices and plastics, the number of plastics that we produce and just throw away single use plastics that just get thrown away in this country. It's just enormous and we've got to address it We. We can't just pretend that it's not happening. It's happening all around us. And if I could leave us with anything, it would be the message that I heard many years ago at a conference which is **there is no away**. So, when you think about something you use and then you throw it away, there is no away and think, but think about plastics and the amount that we throw away. Well, it's not going away. It's accumulating. It's accumulating around us, and we've just got to address this problem.

(00:23:39) Nataliya Shcherbatyuk

Yeah, absolutely! And I have to admit I'm quite new to this topic and this project but it's becoming my passion really really deep into my heart. And I think the first time that I've heard this quote was from you during one of our meetings, and it clicked to me. It's like oh my goodness this is so deep and it's so true because it's easy for us to say just threw it away but there is no away. it's somewhere, yeah.

(00:24:05) Carol Miles

Right, and I think that what we're going to find, you know, going ahead in the next ten years, is that plastic pollution is going to be one of the major global problems that the world society is going to have to deal with because plastics are everywhere.

(00:24:21) Nataliya Shcherbatyuk

Yeah, it is. Well, thank you so much, Carol.

(00:24:28) Carol Miles

Thank you.

(00:24:30) Nataliya Shcherbatyuk

That's it for today and until the next episode. You can find more information by following us on Instagram and LinkedIn by @mulch_matters and going to our websites www.smallfruits.wsu.edu and choose mulch technologies. This work is supported by Specialty Crops Research Initiative Award 2022-51181-38325 from the USDA National Institute of Food and Agriculture. Any opinions, findings, conclusions, or recommendations expressed on this podcast are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

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