

MULCH MATTERS EP. 23

# From Wood Chips to Mulch: A Conversation on Lignocellulose Film with Aidan Williams

[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.

[00:01:25] Nataliya Shcherbatyuk:

Hi Aidan. How are you today?

[00:01:27] Aidan Williams:

I'm good. How are you, Nataliya?

[00:01:30] Nataliya Shcherbatyuk:

I'm pretty good. So, I'd like to start today with your background first, can you tell us who you are, what you do, a little bit of your background and well, basically all about yourself?

[00:01:45] Aidan Williams:

Well, my name is Aidan Williams. I grew up in the Pacific Northwest and I've always loved the natural world and that led me to move up to Bellingham and go to Western Washington University. My bachelor's degree is in Environmental Science. I had an emphasis in freshwater and terrestrial ecology, large systems, but throughout my time there I took an agroecology class and that really sparked my interest in agriculture and food production and kind of how we can make it more sustainable basically. So then I was contacted by Dr. Lisa DeVetter, who's my advisor, she introduced me to a master's program, I am a master's in agriculture student, and I work with her program, the Small Fruit Horticulture Program. And I basically evaluate a bio-based biodegradable mulch, and that includes its functionality as well as some kind of extra work regarding how consumers feel about biodegradable mulches.

[00:03:02] Nataliya Shcherbatyuk:

Oh, that sounds pretty exciting and interesting, and we do talk a lot about much on our podcast, but a little spoiler, you know, today we will be talking about quite different mulch than we used to talk up to now and I

wanted to ask you what actually inspired you to explore lignocellulose film? From now on I'll be using LCF for that, as a mulch alternative. So, what was that that you got so interested in working on this mulch?

**[00:03:40] Aidan Williams:**

Well, because of my background in environmental science, I've always known that non-biodegradable plastic was an issue and impacted, you know, the ecology around us. But when I entered the world of agriculture and I found out just how much agricultural plastic waste is produced, it really blew me away just because it's not something that's talked about, I think, outside of agriculture. And so, the idea of working on a bio-based film, so lignocellulose film is a bio-based film, that really intrigued me seeing as it could be a great solution, if a lot of effort was put into it. And so that's really what inspired me to move forward and analyze kind of sustainable alternatives in agriculture.

**[00:04:30] Nataliya Shcherbatyuk:**

Can you walk us through the process of how this LCF is made from woody biomass?

**[00:04:37] Aidan Williams:**

Yeah, so LCF—lignocellulose film—is created through kind of dissolution and regeneration process. But I want to start at kind of the beginning. Basically, LCF, lignocellulose film, is composed of lignocellulose biomass, which is just a long scary word for the components of plant biomass. And that includes hemicellulose, cellulose and lignin and that is all harnessed through using things like renewable woody biomass. And so wood chips are ground into a fine powder, and this is kind of an optional step, but biochar is added to that powder as a completely bio-based colorant basically, and once that's mixed together, it's put into a molten salt hydrate solution, which basically just dissolves and disperses all those like no cellulose molecules. So that it's able to be cast into a sheet similar to how paper is cast. And then it's washed and regenerated. And we're left with a completely bio-based film at the end.

**[00:05:53] Nataliya Shcherbatyuk:**

That's pretty interesting. And, you know, we've spoken on our podcast not only about plastic mulch and biodegradable mulch, but we also spoke quite a bit about paper-based mulch, like hydromulch, for example. And what makes LCF unique compared to those type of mulches, specifically compared to biodegradable or paper-based mulch?

**[00:06:20] Aidan Williams:**

Well. It's a bio-based film. So, it is cast similar to paper, but it's a film in a sense that it's more similar to the extruded plastic. So, PE, the traditional plastic mulch as well as soil biodegradable plastic mulch. So, it is a bio-based version of those plastics rather than paper, which is bio-based. And so therefore it's inherently biodegradable and it's compared to paper mulch, which is not as efficient in things like weed suppression and temperature regulation. So, the effort is to move toward a bio-based film that has those properties similar to soil biodegradable plastic.

**[00:07:11] Nataliya Shcherbatyuk:**

Okay. That's okay. I got it. I got it. It's a lot.

**[00:07:17] Aidan Williams:**

It's a lot.

**[00:07:18] Nataliya Shcherbatyuk:**

Well, and I mean, it's important you brought it up because there is a lot of, I would say, confusion or misconception about biobased and biodegradable, and it's definitely not the same. So, it's important that you separate that into the explanation.

**[00:07:35] Aidan Williams:**

Exactly. Which just because it's one doesn't mean it's the other.

**[00:07:38] Nataliya Shcherbatyuk:**

Exactly. Yeah. Well, and I know you've been doing very interesting greenhouse trials with raspberry plants, right. So, can you tell us a little bit about those trials that you've done with raspberry plants and a little bit of what were the main objectives and what did your study show about LCF?

**[00:08:02] Aidan Williams:**

So, the main objectives were basically just to analyze LCF functionality as a mulch in general. But also compared to those commercially available mulches, like the paper mulch and, you know, PE plastic mulch and evaluate it for its performance in things like soil temperature optimization and weed suppression. And overall plant growth. So, this greenhouse trial, it was very short-lived, but what we could take away from it was that there weren't any statistically significant differences between the growth of the raspberry plants that were grown in the experimental film in LCF compared to that of the commercially available mulches, especially so specifically in regarding node count and plant height at the end of the trial. Some changes in plant height as well as above and below ground biomass. So, it didn't impact the growth of the raspberries throughout the trial.

**[00:09:07] Nataliya Shcherbatyuk:**

Uh, were there any surprises that you did not expect, but you saw that?

**[00:09:14] Aidan Williams:**

Well, in regard to temperature regulation, the LCF did not have any biochar in it. So, there were multiple experimental films in this mulch, it actually exceeded the soil temperature retention of PE. It wasn't statistically significant, but I thought it was really interesting because PE is known to kind of be the best at maintaining soil temperature. LCF although marginally it did exceed it for a little while. There was a cellulose-based film that my collaborators at the University of Wisconsin Madison created, and it had the most weeds out of all of the other films in the trial and we can kind of attribute that to a kind of greenhouse effect because this specific film didn't have any colorant in it. It was just kind of semi-transparent. And so that can lead to the warming of and kind of the nurturing of those weed seeds under the soil and interestingly, LCF with biochar performed similarly to PE

and paper mulch when it comes to weed suppression. But I do want to consider that this is a small-scale study with a very controlled greenhouse environment, so it would be best to draw more like official conclusions from further testing. But I thought it was interesting that LCF performed similarly to PE.

**[00:10:46] Nataliya Shcherbatyuk:**

Well, and that's how we start. Sometimes we start from something small and short term, and if we see interesting results, we expand into the field. And do you know if LCF will be tested more on a bigger scale?

**[00:11:04] Aidan Williams:**

I don't know officially. I know they're working out some details to try and progress it to roll production where you make a long continuous film in order to test it in field environments. But that takes, you know, money and time and all those things.

**[00:11:24] Nataliya Shcherbatyuk:**

So, do you see LCF as promising solution for organic farmers looking to reduce plastic use? And if you do, why is that?

**[00:11:38] Aidan Williams:**

I see it as a very promising solution, but that is if we move forward with that role-to-role production, that is kind of the main hurdle we're facing. But I have chatted with organic growers where they do struggle with mulch selection because plastic mulch is allowed in organic production, but that might not be conducive to their personal ideals toward plastics. And so, creating a functional film that's totally bio-based and could eventually meet all the requirements for biodegradable mulch in organic production, I think would be extremely useful in the organic world, especially in reducing plastic.

**[00:12:29] Nataliya Shcherbatyuk:**

And when you think about near future of the LCF, what do you see as current, or I mean if you are looking for the next couple of years, but what do you see as the current limitation for scaling LCF for commercial use?

**[00:12:51] Aidan Williams:**

I think we're still working on things like I say we, but the collaborators at University of Wisconsin Madison, we are working on engineering, kind of an extruded version of this rather than a cast version. That's all fancy mumbo-jumbo, but it, that would allow for continuous film and that's the biggest hurdle is making sure that we have the equipment to extrude this film have the equipment to move forward with role to role production, because the ingredients within this film are relatively abundant and so it's not necessarily collecting those ingredients, but how we can produce this film on a larger scale.

**[00:13:42] Nataliya Shcherbatyuk:**

And there is an interest, right. That's what I understand. But is there interest for LCF?

**[00:13:51] Aidan Williams:**

Yeah. I know from grower perspective and as well as some plastic manufacturing perspective, it is an interesting alternative that could be used considering it has lignin in it, there's a lot of kinds of cellulose based materials like paper that we talked about, but the inclusion of lignin allows for it to maintain its structure for a longer period of time. And so that's kind of the promising side of LCF in general.

**[00:14:28] Nataliya Shcherbatyuk:**

Interesting. Yeah, I really would like to follow up, you know, and see if larger scale studies will be conducted anytime soon and see how it's just going to go. It's quite exciting and if we look overall on the crops, do you think there are any specific crops or systems that LCF might be the most beneficial?

**[00:14:57] Aidan Williams:**

Yeah, I think systems with quick crop turnaround would probably be most receptive just because we conducted biodegradation experiment very small-scale observational experiment that showed that it degrades quite quickly especially compared to soil biodegradable mulch. And, so it would do well in systems like lettuce or spinach or beets, those kind of things that have a quick turnaround, I think that would be kind of the target audience for LCF.

**[00:15:41] Nataliya Shcherbatyuk:**

That's quite interesting. Yeah. And so, after it's been incorporated in the soil, I'm assuming it's not leaving any fragments. So, when you harvest, let's say spinach. Then leftovers of the films is not the issue. Do I understand that correctly?

**[00:15:59] Aidan Williams:**

I would say so it degraded rapidly within nine months in the soil and mm-hmm two differing locations. We looked at it in a soil environment here on the west coast in Washington versus on the other side of the mountains on the east where it's a little hotter. And they both degraded rapidly. So, the LCF that didn't have any sort of colorant to it reached up to 99% degradation. Those nine months of the soil, and that's compared to PE, so it was very nice.

**[00:16:39] Nataliya Shcherbatyuk:**

You just reminded me about this degradation. So, is that the experiment you've been doing with the mashed bags?

**[00:16:47] Aidan Williams:**

Yeah.

**[00:16:48] Nataliya Shcherbatyuk:**

So, for our audience, can you please tell just a little bit, basically of what was that and, cause I find those experiments quite fascinating, but for me it's a little bit easier to imagine cause I already aware of what you've been doing. But can you tell overall, like what you did and how do you know the degradation of LCF? Because

we mentioned that you've done a short-term greenhouse study, but you also did more to that, so can, can you incorporate a little bit into that?

**[00:17:24] Aidan Williams:**

Yeah. So, we did kind of what's called a quasi-experiment since there weren't a lot of actual experimental film samples. But what we did was we buried a certain amount of films on the east side of the state where we could assess their degradation in that warmer climate and this using mesh bags that were strung together and then buried within a raspberry field over in Prosser, Washington. And then we buried those exact same samples. In those mesh bags at the Mount Vernon station in a blueberry field and then collected a kind of representative sample of each film type every three months approximately, there were some frozen ground issues over in Prosser, but we to the best of our ability, we got them every three months up to nine months. And so, it was just kind of an initial assessment of their infield degradation in environments and basically what we pulled from it was that the experimental films degraded more rapidly in Prosser than in Mount Vernon and as well as the paper mulch. So that wasn't necessarily surprising, but the experimental cellulose film degraded extremely quickly, very fast in both environments. LCF without that biochar reached up to 99% degradation in both environments after nine months. So, we basically assessed the area of the films that we buried and compared that to the area of a PE mulch sample to how they changed over time and how much smaller they got compared to that PE over time.

**[00:19:33] Nataliya Shcherbatyuk:**

Very interesting. How deep did you bury them?

**[00:19:37] Aidan Williams:**

They were about 10 centimeters below the soil from what I remember, we followed a protocol that was established I believe by Brenda Madrid.

**[00:19:53] Nataliya Shcherbatyuk:**

Cool. Very interesting. Very interesting. So you basically just bury them and let them be, and you would come over every three months and dig them up.

**[00:20:03] Aidan Williams:**

Yes. Yes, exactly. And then, and then, look at how they changed over time.

**[00:20:08] Nataliya Shcherbatyuk:**

That's cool. Yeah. Interesting. Well, science, what can say. Well, Aidan, I have one more question for you, and I wanted to ask you, what is the most exciting thing for you to explore next in your research?

**[00:20:28] Aidan Williams:**

Well, that's a great question. Right now, we're working out the details of establishing a webinar like a miniseries webinar that could be associated with bio-based solutions. But we're going to work on putting out the results

of the LCF project in general and including some of the conclusions made by our collaborators. And then I am also really excited to move forward with the publication of my sociological project that assesses those.

**[00:21:09] Nataliya Shcherbatyuk:**

Would you mind telling us a little bit about that? I know it was my last question, but it sounds like it can be interesting as well, the sociological stuff.

**[00:21:19] Aidan Williams:**

Yeah. So, I did a survey basically at two locations in Bellingham. So, it's definitely a small scale study, but I surveyed people at a farmer's market and a grocery store. And did some one-on-one interviews where I basically people's knowledge of plastic mulch use in the United States as well as their not previous knowledge of biodegradable plastic alternatives. And using informed questioning, we kind of worked through what soil biodegradable plastic is and whether or not that would be something that aligns with their values and if they would support growers who are using soil biodegradable plastic and it was a really fun study to conduct, honestly just chatting with people about mulch, but I loved getting their perceptions. Basically, what came out of it was people are quite supportive and they do show interest in monetarily supporting growers who are using soil biodegradable plastic as an alternative to PE since it aligns with their values. And interestingly, the common occurrence that came up was interviewees mentioned using signage to better inform the consumer of what kind of mulch they're using because a lot of the issue comes when soil biodegradable mulch is degrading in that soil environment after the crop has been harvested because there's a lot of previous research showing that growers see that and innately associate it with a messy kind of unorganized grower, even though it is soil biodegradable plastic it looks a lot like non-biodegradable plastic. And that can kind of create an aversion to its use where I wanted to see if consumers really cared about the look of the plastic. And many people just said, maybe put a sign up saying this is soil biodegradable plastic in which case that kind of visceral reaction of seeing what could be non-biodegradable plastic in the soil is then turned to almost just support for using a sustainable alternative.

**[00:24:11] Nataliya Shcherbatyuk:**

Yeah, that makes sense. We do a lot of assumptions just by what we see without kind of understanding the details behind it. Exactly, yeah. Well, that was quite interesting, and I am looking forward to talk to you more about it when you get more information. Yes. So that's a little different today and interesting, and I hope it was educational as well. Thank you so much, Aidan.

**[00:24:41] Aidan Williams:**

Thank you, Nataliya.

**[00:24:46] 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](http://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

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