Exploring hydromulch with Dr. Dilpreet Bajwa: benefits and applications in organic farming

(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.

(00:01:07) Nataliya Shcherbatyuk

Welcome back. If you have listened to our previous episode about hydromulches, you have learned a lot about its benefits and application. And with our speaker today we will dive even deeper into the hydromulch world. So, let’s welcome Dilpreet Bajwa to our podcast. Thank you again, Dilpreet, for joining us today and let's dive in. Could you start by telling a little bit about yourself, your background, and how you ended up working with mulches?

(00:01:45) Dilpreet Bajwa

Yeah. and thank you for this invitation. My name is Dilpreet Bajwa. I am a professor and head of the Mechanical and Industrial Engineering Department at Montana State University. My research area is working with biomaterials and bioproducts, especially cellulosic materials that come from plants. As a kid, I grew up on

a farm, so when our PI [principal investigator] invited me and mentioned a project on hydromulch, I was fascinated. It took me back to my roots, and that's how I got into this project.

(00:02:34) Nataliya Shcherbatyuk

Oh nice! That is so cool. Now, can you please remind us what hydromulch is?

(00:02:42) Dilpreet Bajwa

Sure. If you think about the word "hydromulch," you can divide it into two parts: "hydro" means water, and "mulch" means any material like twigs, leaves, or agricultural residue materials that is applied to the soil surface. Typically, there are two kinds of mulches in the market: biodegradable and non-biodegradable. Hydromulching is a technique where you mix materials in water and spread that suspension or slurry on the soil surface. When this hydromulch dries, it creates a very hard layer on the soil. Mulch is not new, they have been used in the US and Canada for many years, mostly there were use for erosion control. They were applied to the slopes at the highways, commercial facilities, but now there is more interest in using hydromulches in agriculture. Typically, when you think about hydromulch we take water as a major component, and then we add some kind of fibers to it, whether it’s a fiber coming from crop residues, like a wheat straw, or corm stover, or any tree pruning, woodchips, pine bark, and anything you can mix water and then spray it onto the ground. That is what hydromulch is in nutshell.

(00:04:41) Nataliya Shcherbatyuk

And overall, the differences, we have now so many types of mulches, what would you say are the advantages of using hydromulch?

(00:04:49) Dilpreet Bajwa

You're right; there are several kinds of hydromulches available in the market. These hydromulches have been used since the 1920s in agriculture, but they really became popular in the 1950s. Unlike plastic mulches, hydromulches are sustainable material that is very friendly to the environment. There are multiples benefits of using hydromulch. They help suppress weeds, reduce soil water evaporation, maintain soil temperature, increase soil water holding capacity, add nutrients to the soil, and improve crop yield. They also help prevent runoff and sometimes they also help to protect against certain diseases. So, there are a lot of advantages of hydromulch and there are a lot of papers published on the advantages of hydromulch. So, I can give you an example, a single layer of hydromulch can reduce evaporation by 16%, and three layers can reduce it by 32%, so you can really retain the moisture in the soil that can help crop to grow and get better yield.

(00:06:31) Nataliya Shcherbatyuk

Wow, so, it seems like hydromulch has similar benefits to classic plastic mulch.

(00:06:.36) Dilpreet Bajwa

That is true.

(00:06:39) Nataliya Shcherbatyuk

And now if we talk abet more specific to organic agriculture and hydromulches, can hydromulch be utilized in organic farming and be eligible for organic certification? Because we know that organics have their specific criteria for what they can call as “organic” and what can be certified as organic.

(00:07:03) Dilpreet Bajwa

Yes, the organic food market is growing, and more farmers are getting into organic production. So, I would say that these hydromulches can be used in organic agriculture, but it is important to note that many materials that used in hydromulch need to be certified. So, it requires a certified approval certification to include the materials into the hydromulches. The current regulations do not allow soil biodegradable plastic mulches to be used as certified organic in the US. However, if all the components used in hydromulch are organically certified, then it can be used in organic fruit and vegetable production.

(00:08:00) Nataliya Shcherbatyuk

That's fascinating. So, I'm wondering, can you build your own hydromulch? If it’s definitely not for commercial scale, but for a small backyard garden?

(00:08:12) Dilpreet Bajwa

Yes, you can. For our study, we purchased different components for hydromulch online, and all these suppliers clearly stated that their materials were organically certified. This gives you confidence that you can definitely use them in organic agriculture.

(00:08:35) Nataliya Shcherbatyuk

Interesting. Let's talk a bit more in detail about hydromulch and specifically about its applications. You mentioned that hydromulch consists of two, it’s basically hydro, which is water and mulch that are the pieces that are used for mulch. Then you combine it and then you have this slurry or whatever liquid you call it and then you apply it to the soil. But how do you do it? What does the application look like? Can you tell us a bit more about it?

(00:09:04) Dilpreet Bajwa

That's a good question. Hydromulch is applied by pumping the slurry or liquid and the fiber component through a discharge nozzle. Typically, there's a big tank mounted behind a tractor or other mechanical system. This tank has a pump that pressurizes the slurry to come out. Since the materials can separate over time, there has to be constant mixing or stirring. Mostly I see that there are tanks that are like 1000- or 2000/3000-gallon tanks that are mounted on a truck, or a trailer and they have a pump in the back and there is continuous agitation. So, the material flows and it is then simply either spread on the ground or laid as a mat on the surface of the soil. The ratio for the water and organic material or fibers is usually around 35 to 1, meaning 35% water by weight and 1% material, with tackifiers like glue holding the fibers together. The application rate can range from 4000 to 5000 kilograms per hectare.

(00:10:52) Nataliya Shcherbatyuk

Okay, so the way I see it. It's pretty similar to what the spray application would be when we yeah spraying our fields it just you need to consider probably the viscosity and speed that you put in it on the ground and things like that. Is that correct? So can you adjust like a traditional tractors sprayer or do you need to really create something new for the sprain procedure?

(00:11:17) Dilpreet Bajwa

An important point is that viscosity. When you mix fibers and tackifiers in water, it becomes a thick liquid requiring a strong pump and mixing system. You can use a hand pump for small plots but may need to change the nozzle to a fan nozzle for thicker material. Most of the nozzles are designed for water, but if it is a fiber and thick material, you may have to use a fan nozzle like a fan. So, a material can come out. But again, you're right, it can be spread directly to the soil.

(00:12:00) Nataliya Shcherbatyuk

Okay, now visually I can understand what's going on in the field. And so we spray the mulch, we have hydromulch already applied to our soil. It does what it's supposed to do with its job throughout the season. But what happens to that hydromulch at the end of the growing season?

(00:12:20) Dilpreet Bajwa

So, at the end of the growing season: if you think about hydromulch there are two components - water and then there are fibers. So, water evaporates, you know if when the heat with the sun. So, what is left is the organic matter of your fibers in whatever fibers you use mostly cellulosic fibers. So, at the end of the season most of the time you will see the biodegradable mulches, if you are using either paper, or cotton, or wheat, straw or some other materials that are from crops, they tend to decompose into the soil. So, most of the material tends to decompose, it depends on the temperature and the moisture also because if it is warm moisture it decomposes faster. But if it is cold and dry then it takes a little longer to decompose, but in the end everything goes back to the soil.

(00:13:19) Nataliya Shcherbatyuk

Okay, so there is no planning work with the soil that you should be doing at the end of the season or do you till in into the soil?

(00:13:29) Dilpreet Bajwa

You till into the soil because it is mostly organic matter, when you till into the soil and that also helps to improve the soil fertility if once it decomposes.

(00:13:39) Nataliya Shcherbatyuk

That's great. It also has additional benefit to all the benefits you already mentioned. Plus, we don't need to take it out of the field. Basically, you leave it in the field, and it has a positive benefit for soil fertility. So that sounds like a good deal now for hydromulches.

(00:13:56) Dilpreet Bajwa

That is one of the major advantages of using hydromulch compared to the plastic mulches because plastic mulches don't have that added benefit when at the end of the growing season you have to remove them and there are a lot of studies that talk about that how the plastics turn into microplastic small pieces, and they get into the soil.

(00:13:39) Nataliya Shcherbatyuk

So yeah, that is correct, that sounds very interesting to me, I feel like I will be reading a little bit more now about hydromulches and I hope we got our listeners also to get a little bit of interest in hydromulch. I'm thinking about the weather itself. So, I'm on the eastern side of Washington and we don't really have much precipitation. We don't have much rain throughout the season. But if you look at the western side of Washington it rains quite often. So now I'm wondering if you're using this hydromulch in places like in western side of Washington or other places where rainfall is quite often, how this hydromulch performs during the rainfall, how the rain basically affects the hydromulch performance.

(00:15:08) Dilpreet Bajwa

That's another important question and often it is asked how the rain moisture is going to impact the hydromulch. So, I mentioned earlier that hydromulch has 3 major components: water. fibers and the third one is called tackifiers and the tackifier is just think about a glue and so this is the glue that holds the fiber material together and also it adheres to the soil surface. So, these tackifiers materials are natural gums you can buy

in the market. one of them most popular is psyllium husk, you can get from market or xanthan gum, or you can there are several plant oil seed meals that they can hold these fibers together even if it rains there is a very small amount of this hydromulch that is washed out but most of it stays because once the moisture is gone once it dries it becomes again hard. So, it lasts for entire season sometimes even longer than the entire season and there are currently several other plant proteins that you can use as a tackifier, but you have to be careful that the materials that you use are organically certified. Because some materials are natural proteins but the process the way they are processed may not be organically certified. But definitely these hydromulches can take moisture and drain during the entire season.

(00:16:42) Nataliya Shcherbatyuk

Okay, so the way I understand it, when we apply hydromulch, we have three main components that majority of it is water and then we have this glue that you say and some sort of fiber, and when we apply it to the soil the water basically evaporates, so what we have on the soil it's the thick, solid material which consists of fiber and glue. Is that correct?

(00:17:05) Dilpreet Bajwa

That is correct.

(00:17:07) Nataliya Shcherbatyuk

So now, when the rain gets to it, it doesn't actually have any effect because it's already solidified and it's basically strong enough to hold outside rainfall, how it works?

(00:17:23) Dilpreet Bajwa

That is correct. So the glue that I talked about that is tackifier It holds fibers together and a lot of these fibers are interlocked with each other so they are interlocked and they commingled, so they don't separate, when you think about it there is a ground plant cover on the top, there are layers of biomass that also helps the rain at which the force the rain is coming the water is falling it slows down. So a lot of that biomass also helps to protect the hydromulch.

(00:18:00) Nataliya Shcherbatyuk

That's pretty cool. That's definitely something I'll be looking to get some more details on. And I'd like to ask you a question which is absolutely not related to mulches. During our previous conversation, you mentioned that you've traveled a lot, so I'd like to ask you what your favorite place was where you visited. It doesn't have to be only one, of course, and why that place was your favorite?

(00:18:29) Dilpreet Bajwa

Oh, that's a tough question. Every place has unique connectors that you love visiting them, so I'm just thinking which one I should say and what is a good reason. So, I think out of the places I have visited in Asia, Europe, and Americas, I would think the one country that really, I liked was Portugal. There are a couple things what I liked. One, I like the weather, very good weather. I was in couple of places in Portugal, mostly in Lisbon, Braga. I went and tried to get the train right then. Number one was the weather, number two: I like their food because it's right on the coast ocean you can get very good food, very economical, and the fourth people are very friendly. You can go anywhere, people are there. You can talk to people and ask directions. And so, all these things I felt and there are there's a lot of history behind Portugal and very rich history. So, I felt that that's one place really that caught my attention and I want to revisit again.

(00:19:42) Nataliya Shcherbatyuk

Yeah, that sounds like a good reason, but tell me honestly have you been kind of spying on the soil and what they use in their agriculture?

(00:19:51) Dilpreet Bajwa

So, there are a lot of crops because they have very good weather, so they a lot of the oil crops over there, fruit, they grow lots of the crops. They don't have, the land is not or the farms are not as big as the US, they are small farms but they grow pretty much all the crops over there, a lot of vegetables, a lot of fruits over there, and so that's a very diversified agriculture. I did not come across where I can see I didn't venture out to rural areas where there is more either organic farming, where I could see the mulch, but I know in US this is a big thing because here we have a big organic market and so people like to use you know for organic organically grown crops or fruits to use organic mulches.

(00:20:51) Nataliya Shcherbatyuk

Yeah, that makes sense.

(00:20:54) Dilpreet Bajwa

Last summer I visited Ireland. That was my first trip to Ireland. I was in Dublin and I because went to a couple cities in Ireland and I took a bus tour of Ireland and it was very fascinating to see how green and clean Ireland is, especially the Northern Ireland, and there is a lot of agriculture there too. And there is also a lot of sheep, so you see big sheep farms around and the terrain of Ireland is rolling hills and kind of meadows and lush green and it's surrounded by the sea, and I thought Ireland would get a lot of snow, to my surprise Ireland doesn't get much snow. So, their weather is not very cold so they can grow crops and especially fiber crops. They grow a lot of fiber crops and again the people are nice, enjoy visiting different places and again there is a very rich history too there.

(00:21:52) Nataliya Shcherbatyuk

That seems like something I would enjoy a lot, me as the plant lover, just by imagining how green it is. Yeah, I think I would like it there.

(00:22:02) Dilpreet Bajwa

And you can picture when the rolling terrain, all the sheep are open and people, lot of people have farmhouses. Not very big farmhouses but small houses, when you look at the trees and the green pastures and the sheep.

(00:22:16) Nataliya Shcherbatyuk

Well, Dilpreet, thank you so much for being our guest today, that was extremely interesting conversation and I think we will be back with you again to talk more about the hydromulches in the future. What do you think?

(00:22:28) Dilpreet Bajwa

I would love to come back and talk to you about hydromulch, our hydromulch research, some of our recent findings with hydromulch and I again want to thank you for giving me this opportunity to share a few things about hydromulch and our research that we are doing at Montana State University.

(00:22:49) Nataliya Shcherbatyuk

Thank you so much. 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 website www.smallfruits.wsu.edu and choose mulch technologies. This work is supported by the 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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