

Sustainable Mulch

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MANAGEMENT

Plastic Mulches in Horticulture Production



Improved End-of-Life of Plastic Mulches

smallfruits.wsu.edu/plastic-mulches/



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Project director Lisa Wasko DeVetter (left), and assistant editors Nataliya Shcherbatyuk (top right) and Carol Miles (bottom right).

Project Director's Note

Lisa Wasko DeVetter, Associate Professor, Washington State University

The mantra “mulch matters” is firmly rooted within the ethos of our project team as well as among the many cooperators that have contributed to the content of this newsletter. This edition will focus on a key success story made with recycling and I’m delighted to broadcast the accomplishments made by Driscoll’s. In addition, this edition will share updates on trials in Florida after Hurricane Milton, economic insights on the cost-benefits of soil-biodegradable mulches, and explore the environmental aspects of soil-biodegradable mulches. Several stories featured in the newsletter have parallel podcast episodes that you can link to and expand your knowledge on why mulch matters within sustainable agriculture!

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Introducción a Nuestra Nueva Sección de Recursos Disponibles en Español

Gracia Puerto, WSU Skagit County Extension

¡El programa de extensión e investigación de horticultura de frutas pequeñas tiene ahora recursos disponibles en español para las tecnologías mulch o de mantillo! Nuestro objetivo es enriquecer a los lectores acerca de las tecnologías mulch por medio de notas y diapositivas informativas que les invitan a conocer las bases y avances de nuestro proyecto. Los lectores tienen acceso a información relevante a las tecnologías mulch como ser, las especificaciones en agricultura orgánica que deben tomarse en cuenta para certificaciones por el Programa Nacional Orgánico de USDA. Comparación en las materias primas de plástico biodegradable en el suelo (BDM, por sus siglas en inglés) según el tipo de material y su origen de extracción o producción. Y los beneficios en producción que comparan el uso de acolchado de polietileno (PE) y BDM en el suelo.

En la agricultura, el uso y adopción de nuevas tecnologías van de la mano con gastos que no siempre pueden ser realizados por agricultores a mínima escala. Es importante evaluar la calidad del suelo mediante métodos de evaluación según diferentes características. Las consideraciones económicas en la adopción de BDM en relación con la práctica convencional debe considerar costos, beneficios, y el beneficio neto. Nuestros recursos de información abordan escenarios ejemplo en costos iniciales, y cambios asociados con la adopción de BDM. Resultados de estudios proveen mayor validez y puntos a considerar al momento de considerar BDM en la práctica. Información acerca de comunidades microbianas del suelo mostrando comportamiento de asociación con año, estación, y el tratamiento BDM mostrando resultados de materia orgánica del suelo con evaluaciones en la calidad de suelo según diferentes tipos de tratamientos de acolchado y sin uso de acolchado.

Esperamos proveer mayor número de recursos en español y así seguir brindando apoyo a personas de habla hispana en la comunidad agrícola. La disponibilidad de información en español acorta las barreras que pueden darse a poblaciones hispano hablantes en el alcance de fuentes de información válidas sobre tecnologías novedosas que benefician en las prácticas agrícolas y al medio ambiente. Les invitamos hacernos saber qué información específica acerca de BDM o acolchado PE que le gustaría tener disponible en español. Para más información, por favor contacte a Lisa DeVetter en lisa.devetter@wsu.edu o para asistencia en español puede contactar a Gracia Puerto en g.puertohernandez@wsu.edu

Introduction to Our New Section of Resources Available in Spanish

Gracia Puerto, WSU Skagit County Extension

The Small Fruit Horticulture Research and Extension and Program now has resources for mulch technologies available in Spanish! Our goal is to enrich readers through informative notes and slides that invite them to learn about the basics and advances of our project. Readers have access to relevant information on mulch technologies, such as organic farming specifications that must be considered for certification by the USDA National Organic Program, a comparison of soil biodegradable mulch (BDM) raw materials by material type and its extraction or production origin, and production benefits that compare the use of polyethylene (PE) with BDM in soil.

In agriculture, the use and adoption of new technologies comes with costs that cannot always be borne by small-scale farmers. It is important to assess soil quality using assessment methods based on different characteristics. Economic considerations in the adoption of BDM relative to conventional practices should consider costs, benefits, and net benefit. Our information resources address example scenarios on initial costs, and changes associated with the adoption of BDM. Results of studies provide further validity and points to consider when considering BDM in practice. Information includes soil microbial communities in relation to year, season, and BDM treatment, and soil organic matter and soil quality with different types of mulch treatments and without the use of mulch.

We hope to provide additional resource information in Spanish so that we can continue to provide support to Spanish-speaking people in the agricultural community. The availability of information in Spanish reduces the barriers that can occur to Spanish-speaking populations in the access to valid sources of information on novel technologies that benefit agricultural practices and the environment. We invite you to let us know if there is specific information regarding BDM or PE mulch that you would like us to have available in Spanish. For more information, please contact Lisa DeVetter at lisa.devetter@wsu.edu or for assistance in Spanish you can contact Gracia Puerto at g.puertohernandez@wsu.edu.



Recovery of SCRI Mulch Plots Following Hurricane Milton

Shinsuke Agehara, University of Florida

On October 9, 2024, Hurricane Milton swept over Florida, significantly impacting the state, residents, and farms, including the mulch plots of our SCRI project at the University of Florida, Gulf Coast Research and Education Center in Wimauma, FL. The Florida team quantified the percentage of mulch loss using drone imagery (Fig. 1). On average, the loss was 50% for the biodegradable mulches compared to 36% for the control polyethylene mulch.

In the following week, the team began repairing the hurricane damage (cover photo). To minimize data variability caused by this damage, the team reinstalled mulch for all middle-row plots where data will be collected, while only repairing the damaged plots in the border rows. Understanding how hurricane damage may impact mulch deterioration throughout the season is of practical interest to growers, and the team will assess this by comparing the unrepaired and repaired plots.

One day after repairing the mulch plots, the team planted about 6,000 bare-root strawberry transplants for the SCRI trial (Fig. 2). Despite a delay of about a week in planting, the plants established well in the field (Fig. 3). The project is back on track with minimal impact!



Figure 2. The FL team planting strawberry bare-root transplants (18 Oct, 9 days after Hurricane Milton.)



Figure 3. Strawberry plants established in the SCRI mulch plots (31 Oct, 22 days after Hurricane Milton and 13 days after planting.)



Figure 1. SCRI mulch plots (red outline) at the strawberry research farm, University of Florida's Gulf Coast Research and Education Center in Wimauma, FL (photo taken on 14 Oct, 5 days after Hurricane Milton.)



Microplastics' Impacts on Plant-Soil Systems

Nayab Gull, PhD Student, Washington State University (co-advised by Deirdre Griffin LaHue and Lisa Wasko DeVetter)

A functioning soil-plant system is essential for sustaining food production and thriving ecosystems.

However, microplastic pollution can impact the functionality of this system, and many scientists are focusing on this important area of research.

One impact microplastics can have is on soil physical and chemical properties. Microplastic accumulation in the soil can alter properties like soil structure (how soil particles fit together), water holding capacity, density, and pH, with effects depending on plastic type, size, shape, and amount (de Souza Machado et al., 2019). For instance, fiber-shaped microplastics can decrease soil density but increase water holding capacity. Plant nutrients can stick on to microplastic surfaces and may gradually enrich soil, benefiting plant growth and microbial activity, but excessive release may disrupt nutrient distribution, negatively affecting plants and nutrient cycling (de Souza Machado et al., 2018). Yan et al. (2021) reported that polyethylene (PE) microplastics can enhance nitrogen uptake by roots, while polyvinyl chloride (PVC) restricted nutrient uptake (Fig. 1). Therefore, reported effects on soil nutrients may be positive or negative, but research on this topic remains limited.

Microplastics in the soil may also be taken up by plant roots, damaging cells and disrupting physiological processes (Yu et al., 2019). They may also adhere to root surfaces or penetrate tissues, preventing water and nutrient absorption (Fig. 1). Microplastics, particularly those <2 μm in size, are reported to “exploit” root mechanisms like cell aging or mechanical disruption to enter plant cells (Jiang et al., 2019). Accumulation of microplastics near root hairs can further inhibit plant nutrient absorption, leading to delays in seed germination and hindering growth (Bosker et al., 2019; Qi et al., 2018). There is also concern about bioaccumulation of microplastics in edible plant tissues, which can lead to unintentional animal and human ingestion of microplastics.

Soil microbes are known to drive many essential functions of healthy soils, but their abundance and community make-up can be altered by the accumulation of microplastics in soils (Blöcker et al., 2020; Han et al., 2024). Different microbial types respond variably to microplastics based on factors like microbial cell shape and size, whether they are mobile, and what processes they perform. While some microbes thrive in microplastic-rich environments, others experience stress and reduced survival and reproduction. Certain compostable plastic films increase the abundance of some types of fungi but can decrease diversity of arbuscular mycorrhizal fungi (a type that forms symbiotic relationships with plants) due to chemical toxicity (Fan et al., 2022) (Fig. 1). Microplastics can also cause competition between microbial types, potentially impacting microbial community structure and soil functioning (Wang et al., 2021). Ultimately, microplastic-induced stress

may decrease abundance of vulnerable microorganisms, reducing overall community diversity in soil (Xu et al., 2021), which could have implications for soil health.

Similarly, microplastics can impact soil fauna (larger organisms like earthworms, mites, arthropods) through ingestion, bioaccumulation, habitat alteration, and behavioral changes. Ingested microplastics in soil fauna can cause digestive issues and reduced feeding efficiency, while their accumulation in animal tissues may lead to toxicity (Cui et al., 2022). Soil organisms, such as earthworms, can move microplastics within the soil profile through their burrowing activities (Fig. 1) (Wang et al., 2019). Microplastic-induced changes in soil structure affect habitat suitability for fauna, influencing their distribution and behavior by inducing toxicity or ingestion (Kublik et al., 2022).

Overall, the effects of microplastics on soil-plant processes are variable and depend on several factors. However, studies should be interpreted with caution, as many use dosages that don't reflect real-world conditions, and effects may differ in more complex natural systems (Li et al., 2024; Sajjad et al., 2022). Despite this, reducing microplastics in soils is widely recognized as important for long-term soil health and functioning.

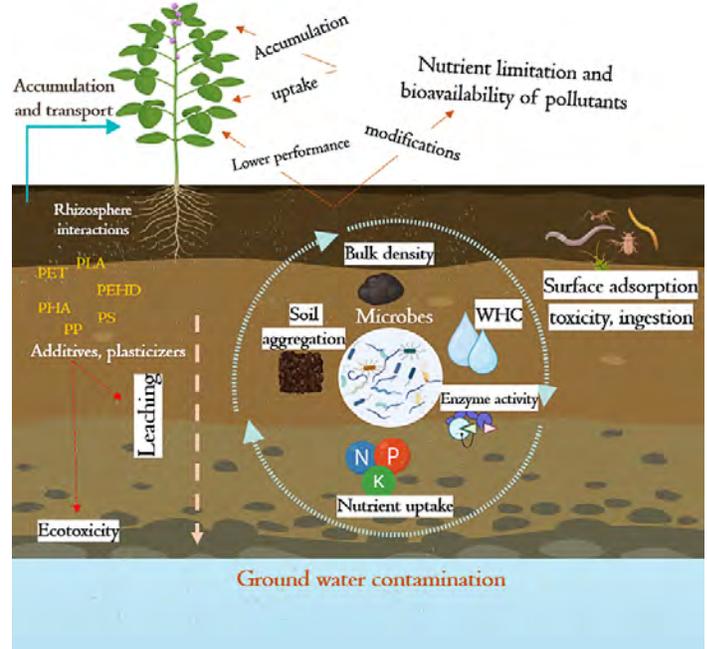
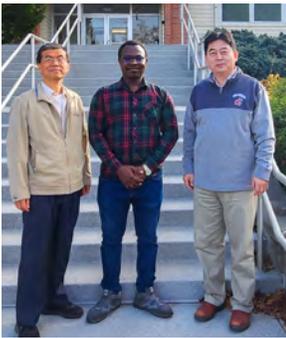


Figure 1. A conceptual illustration of impacts of microplastic accumulation on above and below ground functions, and soil micro-macro fauna (illustration by Nayab Gull).

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Exploring the Environmental Footprint and Cost Considerations of Plastic and Biodegradable Mulches in Agroecosystems

Oluwatumise Dada, Liang Yu, and Ting Chi, Washington State University

PLASTIC IN AGROECOSYSTEMS

Polyethylene (PE) mulch films have become widely used in agriculture, introducing plastic materials into both farming and nearby ecosystems (Sintim and Flury, 2017). This adoption is largely due to the many benefits PE mulch provides, such as reducing weed growth, conserving soil moisture, regulating soil temperature, enhancing crop yield and quality, etc. However, with the increasing reliance on PE mulch in farming, there are concerns over the buildup of micro- and nano-plastics from plastic residues (Kumar and Sheela, 2021; Serrano-Ruiz et al., 2021; Taylor et al., 2020), the release of toxic emissions like dioxins and particulates during plastic waste incineration (Verma et al., 2016), and the leaching of additives and plasticizers into the environment as plastic fragments degrade under sunlight and in landfills (Iskander et al., 2016; Yao et al., 2022). This also raises health concerns due to potential plastic ingestion through bioaccumulated plastics in foods consumed by humans and animals (Madrid et al., 2022b; Taylor et al., 2020). Consequently, there is growing interest in soil-biodegradable mulch films (BDM) as an eco-friendly replacement, which are intended to be tilled into the soil where they biodegrade. Despite the benefits, the widespread adoption of BDM has been slow. Could this be driven by environmental worries or economic factors? A comparative assessment examining the environmental and economic impacts of PE mulch versus BDM may shed light on this.

ENVIRONMENTAL BURDENS OF POLYETHYLENE AND SOIL-BIODEGRADABLE MULCH FILMS

The environmental impacts of both soil-biodegradable and PE mulches are disproportionately influenced by certain life cycle stages (Fig. 1). The manufacturing phase significantly contributes to these impacts, primarily due to the high consumption of materials and energy, leading to elevated non-renewable energy use (NREU) and global warming potential (GWP). Crop yield tends to remain similar during the usage of both BDM and PE mulch (Gao et al., 2022; Tofaneli and Wortman, 2020). However, PE mulch presents a greater environmental post-use concern as plastic residue can adversely affect soil health. BDM, especially starch-based BDM, generally performs better than PE mulch regarding energy use and greenhouse gas emissions, though they may lead to more eutrophication, acidification, and land use impacts (Broeren et al., 2017; Hottle et al., 2017; Tsiropoulos et al., 2015). Conversely, polyester-based BDM, such as PBAT, display lower human toxicity, eutrophication, freshwater ecotoxicity, and marine ecotoxicity potentials, though they contribute more than starch-based BDM to greenhouse gas emissions and energy use due to resource-intensive production processes. Thus, if climate change is the primary concern, starch-based BDM can offer a more viable solution.

Effective end-of-life (EOL) strategies are essential, particularly for PE mulch that requires removal, collection, transport, and disposal after use, adding to its environmental and economic footprint. Soil biodegradation is the intended end of life for BDM and it is more cost-effective than composting. The environmental impact of PE mulch increases after use due to the need for waste management, including options like recycling, landfilling, incineration, on-site storage (i.e., stockpiling), or burning. In particular, mechanical recycling is preferred, although the process requires managing eutrophication and ecotoxicity potential that may result from extensive cleaning of physical and chemical contaminants from mulch films (Brodhagen et al., 2015).

Alternative disposal methods also have notable environmental effects. Incineration, for example, raises concerns about greenhouse gas and photochemical emissions, including CO₂, SO₂, and NO₂, especially when impurities are present. Studies show that mechanical recycling is 2–3 times more beneficial in reducing fossil fuel use than incineration (Dong et al., 2022). Burning of mulch waste can release harmful pollutants, including dioxins, particulate matter, CO₂, PAHs, and furans (US EPA, 2014; Verma et al., 2016; Yao et al., 2022). Landfilling can result in toxic leachate contaminating soil and groundwater (Limoli et al., 2019; Siddiqua et al., 2022; Xu et al., 2018), while the breakdown of PE mulch waste leads to microplastic accumulation, harming soil health and microbial diversity (Zhang et al., 2020; Ng et al., 2018). Additionally, agricultural chemicals adsorbed on PE mulch waste may leach into soil and groundwater during rainfall or irrigation, further increasing environmental toxicity.

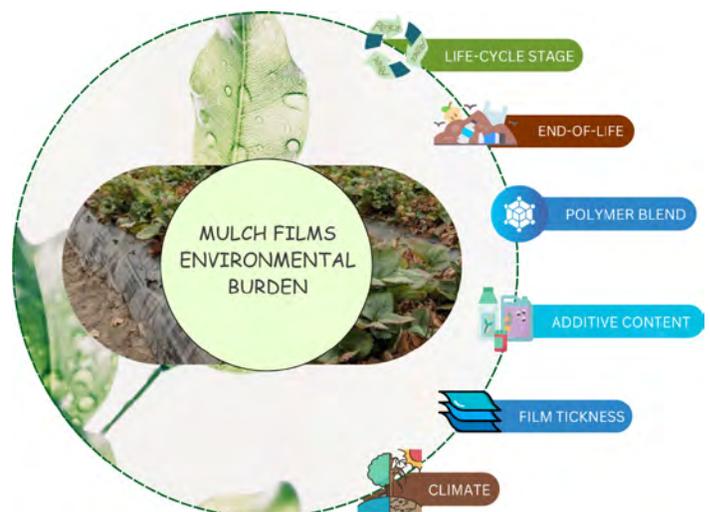


Figure 1. Factors affecting environmental burdens associated with mulch films.

The type of polymer blends used in BDM production can contribute significantly to environmental burden as this influences the material production pathway and largely determines the degradation rate of the BDM. Increasing starch content and reducing PBAT and PBS in polymer blends are recommended for greater sustainability (Broeren et al., 2017). Additionally, additives that improve mulch film properties contribute to environmental burdens, so minimizing their use in BDM production is advisable to preserve compostability and degradability. Film thickness influences energy requirements, material use, and degradation rates, as thicker films require more resources and thinner films fragment into smaller particles faster. Environmental conditions also affect mulch performance: in semi-arid regions with high seasonal rainfall, mulch may not be needed to increase crop yield or conserve soil moisture, whereas in cooler or drier climates, mulches can improve soil conditions and benefit crop growth (Dong et al., 2022; Snyder et al., 2015).

IS SOIL-BIODEGRADABLE MULCH FILM A SUSTAINABLE ALTERNATIVE TO PLASTIC MULCH FILM?

Having displayed significant advantages in the entire life cycle, starch-based BDM are sustainable replacements for PE mulch, but polyester-based BDM has the potential to aggravate environmental impacts in terms of energy use and greenhouse gas emissions. However, co-blending polyester polymers such as PBAT in low ratios with other polymers such as starch could be more sustainable due to their lower toxicity and eutrophication potentials.

WHY IS SOIL-BIODEGRADABLE MULCH FILM NOT YET WIDELY ADOPTED?

The question remains: why hasn't BDM been widely adopted? Despite its clear advantages, the extensive use of BDM as a replacement for PE mulch is still under discussion, hindered by several barriers. Key barriers include the higher purchase costs, concerns over uncertainties of BDM residue residence time in soil, and potential effects on soil health. Insufficient knowledge about the benefits of BDM, the appearance of BDM fragments in fields, and durability issues also contribute to skepticism among growers.

From an economic perspective, higher purchase costs limit widespread adoption. The higher manufacturing costs of BDM translate into higher purchase prices, making PE mulch more appealing to farmers. However, when the cost of removing, transporting, and managing PE mulch waste is considered, the overall cost of BDM may be more favorable, as these additional costs are eliminated. Environmentally, major concerns limiting BDM adoption include uncertainties regarding its biodegradation in agricultural soils and potential effects on soil health (Bandopadhyay et al., 2020; Goldberger et al., 2015; Madrid et al., 2022a). The varying biodegradation rates in soil are due to the different feedstocks and additives used in BDM production as well as the soil environment.

CONCLUSIONS

In conclusion, while BDM offers environmental benefits, their perceived high cost remains a primary barrier to widespread adoption, particularly among growers. Addressing both the environmental impacts and perceived economic challenges of BDM is essential. Although the expenses at the end of the season are often higher for PE mulch than for BDM, until BDM is perceived as economically viable, adoption may remain limited. Outreach efforts can help address these perceived economic barriers by helping growers take into account of the full costs of a particular mulch type, including initial costs, removal, and disposal. Research and outreach can also help address concerns about BDM residue on soil and environmental health. Legislative support, government incentives, and policy could play a crucial role in overcoming these barriers and encouraging broader use, with the goal of reducing plastic pollution. Improved information dissemination can help close the knowledge gap and reshape growers' perceptions of BDMs. Additionally, further studies are needed to evaluate the long-term effects of BDM residues on soil health and microbial communities.

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Assessing the Economic Viability of Soil-Biodegradable Mulch (BDM) Films in Agriculture

Suzette P. Galinato, Washington State University.

Co-Authors: Margarita Velandia, Srijana Shrestha, Shuresh Ghimire, and Lisa Wasko DeVetter

Sustainable agriculture production practices are becoming increasingly important amid growing awareness of the need to reduce environmental pollution. Producers are more inclined to use innovative and sustainable technologies such as soil-biodegradable mulches (BDM) when they see improvements in production efficiency, crop yield, and farm profitability in addition to reductions in the environmental impacts of their production practices.

When considering the suitability of new technologies, it is important to evaluate several factors. First, the costs, including material and labor expenses, must be assessed. Second, the benefits relative to standard practices, such as increased crop yield and cost savings on production inputs, should be considered. Finally, the net profit—the difference between revenue and costs—ultimately determines the economic feasibility. The overall picture is important—which practice generates a higher net profit? If the new technology generates a higher net profit, it is more profitable than the standard practice.

In the case of BDM, they generally come with a higher purchase cost compared to traditional polyethylene (PE) mulch. To justify the higher cost of BDM, producers must assess whether potential savings can offset the product's cost. This involves calculating the costs associated with PE mulch - material costs, labor costs for mulch removal, and disposal costs, which can vary significantly by location. For example, disposal fees range from \$50 to \$93 per ton in California, \$55 to \$99 per ton in Washington, and the national average is about \$58 per ton (EREF, 2024). Some landfills may not accept PE mulch for disposal. With BDM, there is no need to remove the mulch, but drip tape must still be removed. Tilling BDM into the soil will involve operator labor, however it may not be an additional cost if tillage is already part of typical end-of-season field activities.

Table 1. Calculation of net change in profit by adopting BDM.

Changes Associated with Adopting BDM (\$ per acre)			
Additional Income (AI):	\$0	Additional Cost (AC):	\$190.00
• Current assumption: No changes in price & yield		• BDM material cost	\$190.00
Reduced Costs (RC):	\$278.83	Reduced Income (RI):	\$0
• Labor savings:	\$270.90	• Current assumption: No changes in price & yield due to BDMs adoption	
• Disposal savings:	\$7.93		
B. Total AI and RC:	\$278.83	A. Total AC and RI:	\$190.00
Net Change in Profit (A - B): \$88.83			

Note: Underlying assumptions of the calculations can be found in Velandia et al. (2024).

To illustrate the economic feasibility of using BDM, let us consider a hypothetical scenario focusing on changes in income and expenses. The higher material cost of BDM adds an expense of \$190 per acre compared to PE mulch. However, the benefits of using BDM must be considered: there is a labor cost savings of approximately \$271 per acre due to the elimination of PE mulch removal, along with disposal cost savings of about \$8 per acre (Table 1). Overall, using BDM can potentially lead to a net profit increase of approximately \$89 per acre.

Sensitivity analyses of net profit, given variations in material costs, labor hours, and labor rates, illustrate the thresholds at which using BDM or PE mulch would be a more profitable option. For example, at a cost of \$265 per roll, net profit can increase to \$189 per acre when using BDM instead of PE mulch. But if the cost increases to \$390 per roll, this can shift to a loss of \$61 per acre. There is neither a loss nor gain when the mulch costs about \$359 per roll (Fig. 1). Additionally, increasing labor hours for PE mulch removal enhances the cost savings associated with using BDM. For instance, if 22.25 labor hours per acre are needed to remove and dispose of PE mulch, the net profit when using BDM is higher by

about \$175 per acre (Fig. 2). Conversely, if 7.25 labor hours per acre are required, the net profit is lower than that of PE mulch by about \$83 per acre (Fig. 3). The difference in net profit is zero at 12 hours per acre. The cost of labor also affects net profit; it is more profitable to use BDM when labor costs are above \$11.60 per hour.

There are economic tools that have been developed for producers to assess the feasibility of on-farm adoption of BDM—a Mulch Calculator that calculates the quantity of mulch needed and provides cost comparison between BDM and PE mulch (Chen et al., 2018); and a Mulch Use Flow Chart that calculates and compares the gross profit when using PE mulch, BDM, or bare ground (Galinato, 2021). Producers can enter their costs and revenue associated with mulching, with examples provided for selected crops, including strawberries.

It is important to keep in mind that while BDM has a higher purchase cost, the elimination of end-of-season activities related to PE mulch can lead to significant cost savings. BDM may be more profitable under certain situations, such as when labor costs are high or when substantial labor is needed for PE mulch removal and disposal. Assessing the

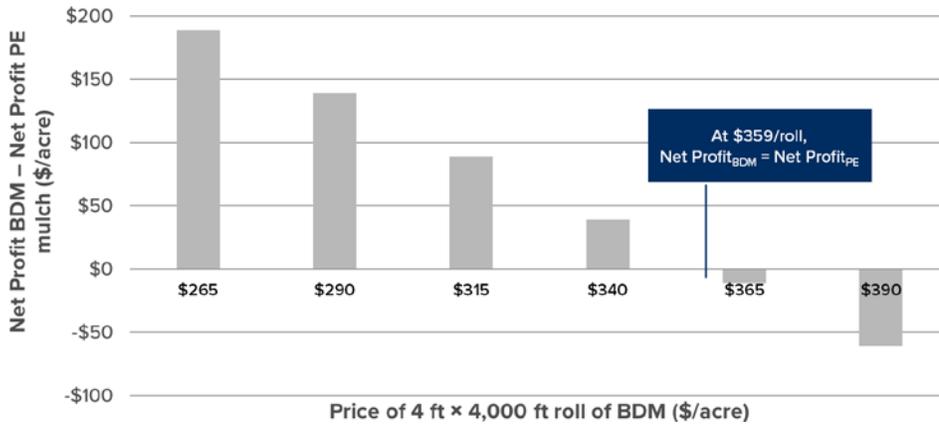


Figure 1. Sensitivity analysis of net profit given different prices of BDM material. Source: Velandia et al. (2024)

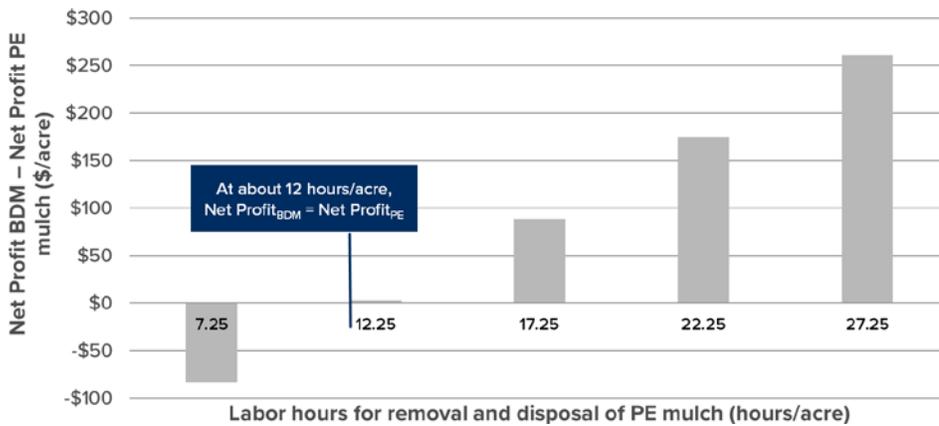


Figure 2. Sensitivity analysis of net profit given labor hours to remove and dispose PE mulch. Source: Velandia et al. (2024)

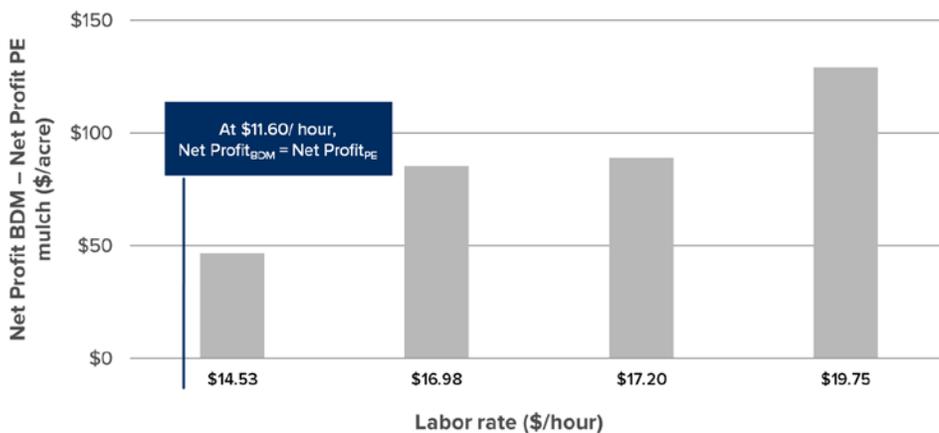


Figure 3. Sensitivity analysis of net profit given the minimum, average, median and maximum hourly labor rate in the U.S. as of 2024. Sources: Velandia et al. (2024); U.S. DOL (2024).

economic feasibility of BDM involves analyzing costs, benefits, and net profit in comparison to standard practices. It is essential for producers to look beyond initial expenses and focus on net profit to identify long-term financial advantages offered by BDM.

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Lessons Learned in Sustainability: Driscoll's Path to Plastic Recycling Success

Nataliya Shcherbatyuk, Washington State University

A CONVERSATION WITH JAMES DUBOIS, SENIOR MANAGER OF ENVIRONMENTAL SUSTAINABILITY AT DRISCOLL'S

WHO IS DRISCOLL'S?

Driscoll's, a fifth-generation family-owned company, is dedicated to delighting berry consumers while enriching the lives of everyone they touch. With over 100 years of farming heritage, Driscoll's works with 900 independent growers across 22 countries, focusing on developing and marketing great-tasting berries. Their vision is not just about providing the best berries but also about ensuring that their practices are environmentally responsible and sustainable.

WHAT HAS BEEN ACHIEVED ON PLASTIC-RELATED INITIATIVES?

One of Driscoll's significant sustainability initiatives has been reducing their plastic footprint in berry production. Driscoll's was able to identify recycling channels for many types of agricultural plastics including tunnel film and drip tape, but no such channels existed for plastics such as mulch and fumigation films. By 2022, the company had not recycled any strawberry bed mulch, but by 2024, they managed to recycle nearly 8,000 acres of fumigation and bed mulch plastic. This success marks a milestone for the company and the berry industry. Driscoll's has also collaborated with partners like Andros (**Recycling Services - ANDROS ENGINEERING**) and Flipping Iron (**Ag Plastic Recycling California | Flipping Iron Inc. | Bakersfield**) to create systems for retrieving, cleaning, and recycling field plastics.

MEASURABLE RESULTS

- 8,000 acres of fumigation and bed mulch plastic recycled to date.
- Of the 8,000 acres, 3,000 acres of bed mulch recycled in 2024 alone.
- The cost of recycling plastic is decreasing as the process becomes more efficient, moving closer to cost neutrality for growers.

CHALLENGES AND HOW THEY OVERCAME THEM

Driscoll's faced several challenges in their sustainability efforts, including the high cost of recycling field plastics compared to disposal in landfills and the variability of soil and plant matter contamination in plastic mulch. However, they overcame these hurdles by:

- Partnering with key stakeholders like Flipping Iron and Andros to develop innovative retrieval and processing systems.
- Starting with small pilots in 2022 and growing annual recycling rates for soil contact plastics to 5,000 acres in 2024.
- Engaging with public agencies and foundations to address the financial and logistical barriers to recycling.



Recycling partners



LESSONS LEARNED

One of the critical lessons Driscoll's learned is the importance of collaboration across the industry. Scaling sustainability efforts requires engagement from not just growers but also manufacturers, marketers, recyclers, and public agencies. Cost neutrality remains a key focus, and finding efficiencies through mechanical recycling and partnerships is crucial to making recycling more accessible and sustainable for all involved.

Driscoll's has also learned that the market for recycled plastics can be volatile, and they continue to adapt to changes in pricing and market demand. Despite these challenges, they are committed to their long-term sustainability goals and remain optimistic about their efforts to create closed-loop systems in the berry supply chain.

WANT TO HEAR MORE?

Driscoll's has shown that with determination and collaboration, real progress is possible. Their commitment to sustainability has transformed the way plastic waste is managed in the berry industry, proving that innovation and persistence can lead to meaningful change. From overcoming challenges to creating impactful partnerships, their story is an inspiring reminder that every step towards sustainability counts.

*You can also hear directly from **James duBois on our Mulch Matters podcast**. James is a Senior Manager of Environmental Sustainability and has 15 years of experience in water stewardship and environmental risk management. He shares more insights into Driscoll's journey toward sustainability. Tune in for the full conversation!*



Sustainable Solutions with Soil-biodegradable Mulch: Lessons from Novamont

Nataliya Shcherbatyuk, Washington State University

A CONVERSATION WITH DAN MARTENS, VICE PRESIDENT NORTH AMERICA, NOVAMONT

NOVAMONT'S MISSION AND BACKGROUND

Novamont, headquartered in Italy, was founded with a mission to create sustainable solutions. The heart of their innovation is a bioplastic polymer called Mater-Bi, which can be used to produce compostable and biodegradable products like soil-biodegradable mulch films (BDM). These materials are designed to break down naturally in the soil. As Dan Martens, Vice President of Novamont in North America explained, Novamont's vision is to contribute to a circular economy where products not only serve their function but also are in harmony with the earth.

ACHIEVEMENTS AND MEASURABLE RESULTS

One of Novamont's major accomplishments is the wide adoption of their BDM in Europe. In crops such as tomatoes and sweet corn, these films have been shown to improve yields by regulating soil temperature and moisture. Dan highlighted a key success in Italy where BDM increased tomato production by 25% compared to standard non-mulched tomato. This is not only an environmental win but also a financial benefit for farmers.

Moreover, the films reduce the labor and costs associated with removing polyethylene (PE) mulch. BDM is tilled into the soil, unlike conventional PE mulches that must be removed then disposed of manually.

CHALLENGES AND OVERCOMING THEM

While the benefits of BDM are clear, the transition to BDM has not been without challenges. According to Dan, one of the biggest hurdles has been helping farmers adjust their expectations of the material. "It's not PE, and it doesn't behave exactly like PE," Dan explained. Soil-biodegradable mulch films require different handling, such as being

applied loosely to the soil to account for shrinkage. Understanding the unique properties of the material is key for successful adoption. Through education and trials, Novamont has worked with farmers to understand these differences, helping to facilitate smooth transitions.

LESSONS LEARNED

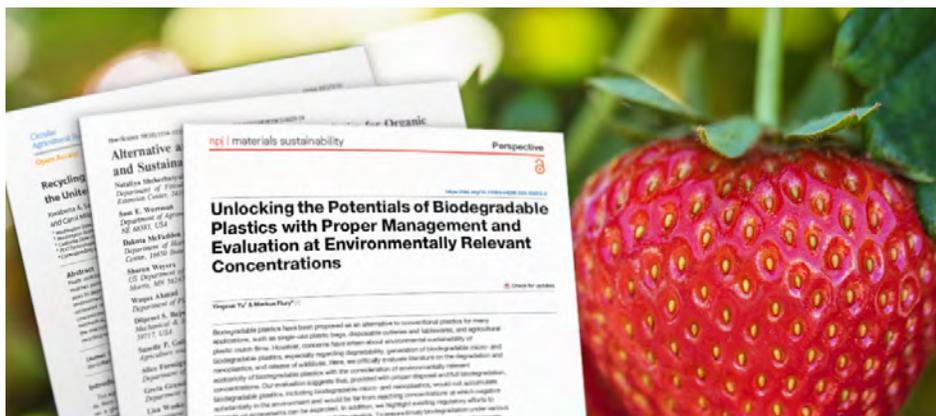
One of the most important lessons Novamont has learned through this journey is the importance of starting small. "We encourage farmers to try soil-biodegradable mulch [BDM] on a small scale before transitioning their entire fields," Dan advised. This approach helps farmers become familiar with the material and reduces the risk of challenges arising from unfamiliarity.

Novamont's work also highlights the importance of collaboration across sectors. They've partnered with universities like Washington State University and University of Tennessee, as well as other stakeholders, to validate their products and provide solid research backing. This support from academia has been instrumental in dispelling myths about BDM and promoting their widespread adoption.

A GLIMPSE INTO THE FUTURE

Looking ahead, Novamont is focused on pushing the boundaries of BDM can achieve. The company is working towards 100% plant-based chemistry for its products and is optimistic about further breakthroughs in BDM. They are also exploring new applications for new crops beyond traditional uses, such as for rice and hemp.

*Tune in and join us on our journey towards a more sustainable future in agriculture! You can hear directly from **Dan Martens, who shares his insights on our Mulch Matters podcast.***



Recent Publications

RESEARCH

Sarpong, K.A., F.A. Adesina, L.W. DeVetter, K. Zhang, K. DeWhitt, K.R. Englund, and C. Miles. 2024. **Recycling agricultural plastic mulch: limitations and opportunities in the United States. Circular Agricultural Systems**. 4: e005 doi:10.48130/cas-0024-0003

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Yu, Y., and M. Flury. 2024. **Unlocking the potentials of biodegradable plastics with proper management and evaluation at environmentally relevant concentrations**. npj Materials Sustainability. 2:9 doi:10.1038/s44296-024-00012-0

Upcoming Events

AGRIFOODPLAST

Dates: April 8 & 9, 2025

Location: Brussels, Belgium

Details on the [Agrifoodplast website](https://agrifoodplast.eu) (agrifoodplast.eu)

ASHS 2025 ANNUAL CONFERENCE

Dates: July 28 - August 1, 2025

Location: New Orleans, Louisiana, USA

Details on the [ASHS 2025 conference website](https://ashs.org/ASHSAnnualConference) (ashs.org/ASHSAnnualConference).

THE 16TH WASTE CONVERSION TECHNOLOGY CONFERENCE & TRADE SHOW (WCTC 2025)

Dates: August 11-13, 2025

Location: San Diego, California, USA

Details on the [WCTC 2025 conference website](https://wasteconversionconference.com) (wasteconversionconference.com).

THE 8TH AGRICULTURAL PLASTICS RECYCLING CONFERENCE & TRADE SHOW (APRC 2025)

Dates: August 13-15, 2025

Location: San Diego, California, USA

Details on the [APRC 2025 conference website](https://agplasticconference.com) (agplasticconference.com).

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