

# SUSTAINABLE MULCH MANAGEMENT

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Plastic Mulches in Horticulture  
Production





**WASHINGTON STATE**  
UNIVERSITY

## Plastic Mulch News

### PLASTIC MULCHES IN HORTICULTURE PRODUCTION

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Washington State University, NWREC*

Welcome to the first addition of the Sustainable Mulch Management newsletter! The purpose of this bi-annual newsletter is to inform readers about the challenges and opportunities associated with the use of agricultural plastic mulches and alternatives that can improve sustainable farming outcomes. New resource information and educational tools will be provided in each future edition.

Plastic mulch has been widely used in horticultural crop production systems since the 1950s for its many benefits including weed management, improved soil temperature and moisture conditions, and overall enhanced crop yield and quality. Most plastic mulch is made from polyethylene (PE), which is a non-degradable polymer. As a result, annual use and removal of PE plastic mulch results in millions of pounds of plastic waste that must be disposed of. Landfilling, stockpiling, and even in-soil burial or on-farm burning are possible outcomes of used PE plastic mulch waste. Some of this waste can escape into the environment, which pollutes both terrestrial and aquatic ecosystems.

Plastic pollution is one of the biggest environmental challenges we face, and agriculture has a role in contributing to plastic waste generation. However, agriculture can also be part of the solution. Researchers have partnered together across disciplines and alongside other institutions and companies with the aim to improve end-of-life management of agricultural plastics (Fig. 1).



#### INSIDE THIS ISSUE

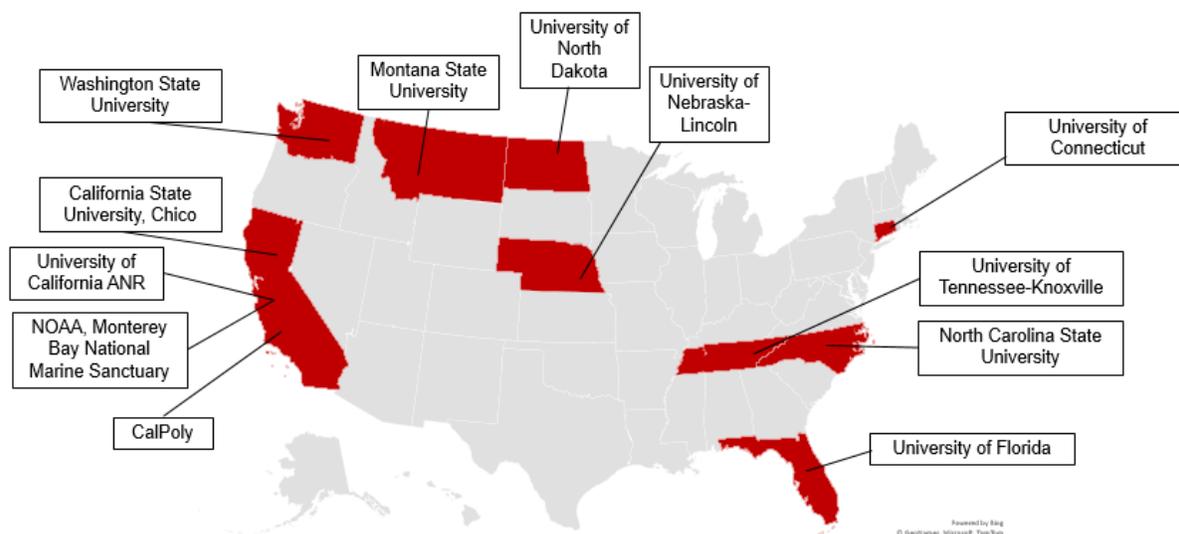
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## PLASTIC MULCHES IN HORTICULTURE PRODUCTION – INTRODUCTION CONTINUED



**Figure 1.** Map of collaborating universities and institutions working on improving end-of-life management of agricultural plastic mulches.

Since the 2004, researchers at Washington State University have been studying soil-biodegradable plastic mulches (BDMs) as an alternative to PE plastic mulch. Soil-biodegradable mulches are made from paper or plastic and are designed to biodegrade in soils upon incorporation through the activity of naturally occurring soil microorganisms. Most studies show yields of crops grown with plastic BDMs are equivalent to PE mulch. However, adoption of BDMs is still in its infancy and both research and outreach efforts are still needed to advance this promising tool.

Recycling is another promising sustainable outcome for used PE mulch. Recycling of PE mulch has been limited to date due to high contamination levels of used PE mulch and costs associated with collecting, transporting, and cleaning used PE mulch. PE mulch is also made from mixed resins and poses challenges in traditional recycling streams.

Despite these challenges, there is a strong interest in recycling alternatives that include new chemical and recycling technologies that hold much potential.

Our research team will continue to study ways to improve end-of-life management and sustainable outcomes that allow growers to benefit from plastic mulch use while minimizing environmental risks. As research findings are generated, this newsletter will provide a platform to share information and tools that will help growers and extension educators improve the sustainability within their own operations and communities.

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## INTRODUCTION TO SOIL-BIODEGRADABLE PLASTIC MULCH (BDM)

Polyethylene (PE) mulch has been used in agriculture for more than 60 years and contributes to crop yield and quality by reducing weed pressure and herbicide use, moderating soil temperature, and conserving soil moisture. Despite its many benefits, used PE mulch is difficult to recycle as it is contaminated with soil and/or vegetation (more than 50% by weight). The lack of affordable recycling and disposal choices has left farmers with few end-of-life options for PE mulch at the end of the growing season. Thus, used PE mulch is often disposed in landfills, or stockpiled or burnt on farms. Some growers may even resort to tilling used PE mulch into soil. Soil-



**Figure 2. Landfilled PE mulch**  
(Photo: Pam Krone).

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***“Soil-biodegradable plastic mulch (BDM) is an alternative to PE mulch as it provides comparable crop production benefits: weed control, moisture retention, soil temperature modification, early harvest, increased yield, and improved quality.”***

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biodegradable plastic mulch (BDM) is an alternative to PE mulch as it provides comparable crop production benefits: weed control, moisture retention, soil temperature modification, early harvest, increased yield, and improved quality. BDMs are made from feedstocks that are: 1) biobased (extracted from natural materials); 2) derived from fossil fuels; or 3) a blend of the two. BDMs are designed to be tilled into the soil after use and thereafter biodegrade in soil. This in turn provides a more environmentally sustainable and low-cost alternative to current methods of PE mulch disposal. Studies to date have shown that BDM does not cause any harm to soil health.

The introduction of BDMs began in the 1990s when the German government

published a call for research and development of biodegradable thermoplastics. In 1991, Novamont introduced the Mater-Bi line, and in 1996 Bayer BAK introduced line extrusion and injection molding grades. In 2009, the United States Department of Agriculture (USDA) Specialty Crop Research Initiative (SCRI) program supported research to investigate BDMs, and this work was carried out by a multi-institutional and transdisciplinary team with project leadership from Washington State University. By 2014, BASF had produced BASF/Organix Solution BDM. Currently, several paper and plastic BDMs are available in the market to help growers improve the sustainability of their farming operations by reducing on-farm plastic waste generation.

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## GRADUATE STUDENT HIGHLIGHT

**Brenda Madrid**

*Washington State University, NWREC*

I'm a master's student in Dr. Lisa Wasako DeVetter's Small Fruit Horticulture Program. The main focus of my research is to evaluate the effect of potentially degrading products on the surface deterioration and visible in-soil degradation of different soil-biodegradable mulches (BDMs). I am also looking into the risks and uncertainties of incorporating polyethylene (PE) and BDMs into raspberry production systems.

Recent studies evaluating BDM degradation have demonstrated that degradation rates are often slower in our region. My work will provide insight about the efficacy of these products to determine if its worthwhile for growers to explore. Furthermore, I hope that by identifying the types of risks and uncertainties that growers and other professionals have it can guide us to provide educational material and/or encourage further research that can help lessen related knowledge gaps.

BDMs may not be a one-size-fit all approach for all production systems currently. I anticipate that as we continue to research and provide educational outreach the adoption of BDMs will increase overtime. I think that BDMs do have the potential to help create more sustainable production systems in the future, and there is value in the work that we are all doing!



**Figure 3.** BDM degradation field study



**Figure 4.** Potentially degrading products applied to BDM surface



**Figure 5.** BDM mulch surface deterioration (Photos by: Brenda Madrid)

## RECENT PUBLICATIONS

Available at:

<https://smallfruits.wsu.edu/plastic-mulches/>

⇒ **What is in a BDM?**

Lisa Wasko DeVetter, Srijana Shrestha, Doug Hayes

⇒ **Frequently asked questions about Soil-biodegradable mulches**

Srijana Shrestha and Lisa Wasko DeVetter

⇒ **Glossary of terms associated with soil-biodegradable mulches for specialty crops**

Carol Miles et al.

⇒ **Soil-Biodegradable Mulch (BDM) Teaching Materials**

Training materials are available for professional development workshops, extension conferences, grower workshops, and undergraduate and graduate courses, which can also be used at the high school level. Materials include PowerPoint slides, presenter notes, short video

⇒ **Plastic mulch use in perennial fruit cropping systems – A review.** Zhang, H., C. Miles, B. Gerde-  
man, D.G. LaHue, and L.W. DeVetter.  
2021. Scientia Horticulturae. 281:109975.

⇒ **In-field degradation of soil-biodegradable plastic mulch films in a Mediterranean climate.** Griffin-LaHue, D., S. Ghimire, Y. Yu, E.J. Scheenstra, C.A. Miles, and M. Flury. 2022. Sci. Total. Environ. 806:150238.



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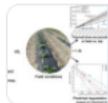
@Mulch\_Matters

Tweets by @Mulch\_Matters

 Lisa DeVetter  
@Mulch\_Matters  
A must read for those working with soil biodegradable mulches!  
<https://twitter.com/deirdregriff/status/1440464245888466949>

Sep 23, 2021

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@Mulch\_Matters  
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Sep 15, 2021

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