January 2024

Improved End-Of-Life of Plastic Mulches

smallfruits.wsu.edu/plastic-mulches/

Soil-Biodegradable Mulch for Crop Production

Authors:

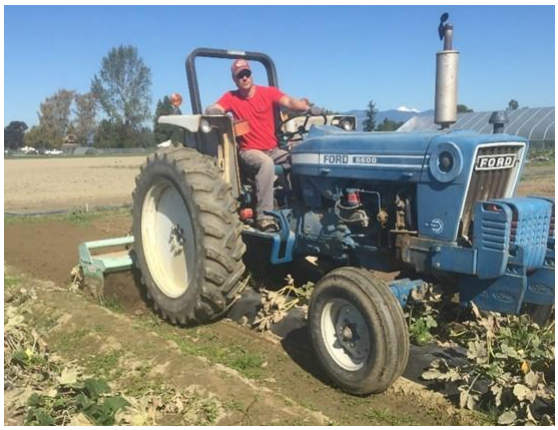
Carol Miles[1]
Shuresh Ghimire[2]
Sam Wortman[3]

[1]Washington State University
[2]University of Connecticut
[3]University of Nebraska

Synopsis:
Soil-biodegradable mulches (BDMs) are increasingly used in agriculture to replace conventional plastic mulch. This outlines the horticultural benefits of using BDMs for horticultural crop production.

These notes provide information for presenters for this slide presentation on use of soil-biodegradable mulches (BDMs) for crop production. Numbers in the text correspond to the slides in the presentation. Information in this document was summarized from publications listed in the Reference section.

1. This presentation provides information on the history and rationale for using soil-biodegradable mulch (BDM), its horticultural benefits, application in organic production, and understanding labels.
2. An alternative to PE (polyethylene) mulch is needed for several reasons. First, the options for PE mulch disposal are limited. PE mulch recycling is limited due to soil and plant debris contamination. Waste disposal through



This material is based upon work that is supported by USDA SCRI award nos. 2022-51181-38325, 2019-51181-30012 & 2014-51181-22382, and Western Sustainable Agriculture Research and Education, under award no. WPDP19-05. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

USDA United States Department of Agriculture National Institute of Food and Agriculture

USDA WASHINGTON STATE UNIVERSITY UCONN CAHNR EXTENSION WESTERN SARE Sustainable Agriculture Research & Education

landfilling and incineration can also be limited. PE mulch is a potential source of environmental pollution. Second, mulch removal is time and labor consuming even with equipment designed to facilitate mulch removal (such as a mulch lifter). It is estimated that up to 10% of PE mulch is left in the field. Note that BDMs are not removable due to ripping.

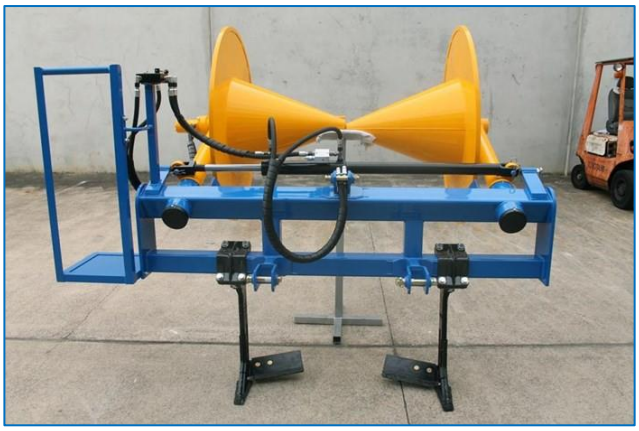


Figure 1. Mulch lifter.

This is an example of a mulch lifter (Fig. 1). The amount of PE mulch being stockpiled in California (Fig. 2) is quite extensive as landfill and recycling are not options for disposal.

3. BDM used in crop production should completely biodegrade, not cause harm to soil ecology, and provide weed control, temperature modification, soil moisture retention, and comparable yield with PE mulch. BDM is designed to be tilled into the soil after use, eliminating waste and disposal challenges. BDMs should not go into recycling facilities as they will contaminate the other recyclables.
4. Crop production with BDMs is shown in Table 1. Yield is greater compared with bare ground and essentially the same as with PE mulch. Weed control varies between BDM and PE mulch depending on crop and location.

Table 1. Crop production with BDM.

	Yield		Weed Control
Crop	**vs. Bare ground**	**vs. PE**	**vs. PE**
Broccoli	+[1]		
Cucumber	+	=	=
Eggplant	+	=	-
Lettuce		-=[2]	
Melon	+	+=	≅
Pepper	=	=	-
Raspberry	+	=	=
Strawberry	+	-=+[2]	-
Sweet Corn	+	-=	-
Sweet Potato	+	+=	+
Tomato	+	=	≅
Zucchini		=	

[1] + BDM performed better; = BDM performed equivalent to; - BDM did not perform as well; empty cell not measured.

[2] Reports provide variable results.

Adapted from: Cowan and Miles, 2018

5. The USDA National Organic Program added biodegradable biobased mulch film to its list of allowed substances in October 2014. However, it **MUST**: **a)** be 100% biobased (*ASTM D6866)*; **b)** be produced without use of synthetic polymers (minor additives such as colorants and processing aids not required to be biobased); **c)** be produced without organisms or feedstock derived from excluded methods (i.e., synthetic or genetically modified organism (GMO); **d)** meet compostability specifications (ASTM D6400, ASTM D6868, EN 13432, EN 14995, or ISO 17088); and **e)** reach ≥ 90% degradation in soil within 2 years (*ISO 17556* or *ASTM D5988).*
6. GMOs are commonly used in the manufacture of BDM. For example, starch feed- stocks (corn, sugar beet) are fermented by GM bacteria or yeast. It is difficult to determine the GMO status of the end product when the source of feedstocks is not disclosed, or when DNA is degraded after fermentation and processing and is thus not measurable. **NO plastic BDMs are approved for use in certified organic production.** Paper BDM (such as WeedGuardPlus™) is allowed for organic production.
7. What does the label tell you? If biodegradability test results are not included in the product label, then it should be assumed that the product does not meet the standards.

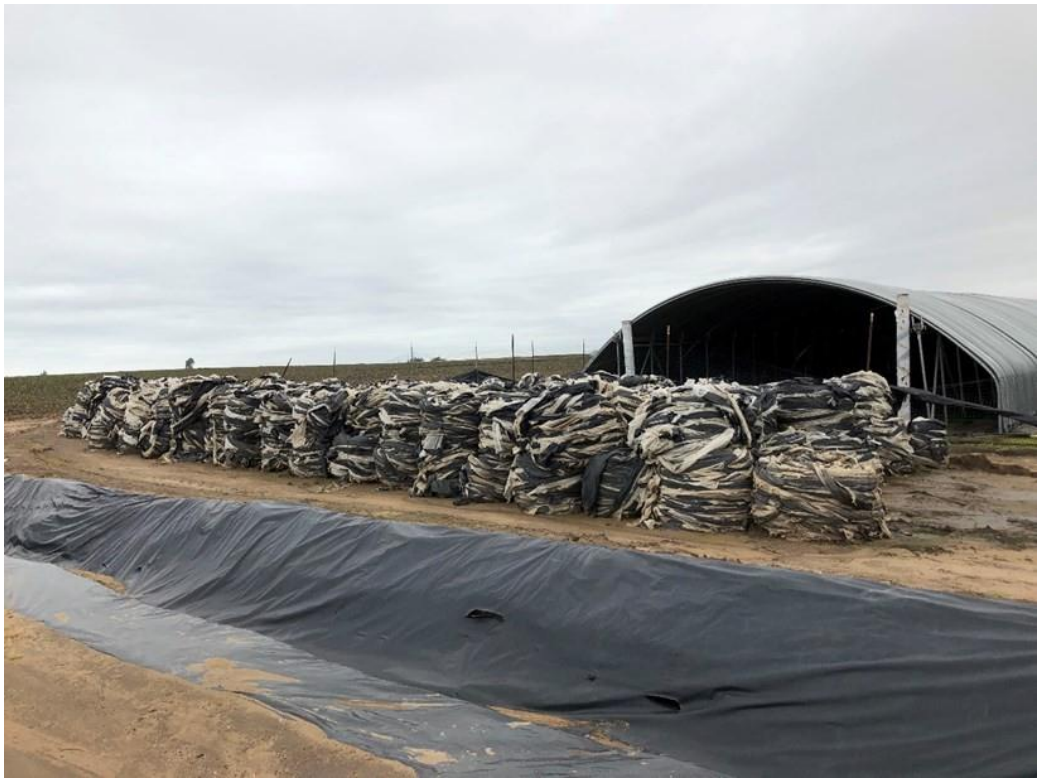


Figure 2. Mulch stockpile.

Photo: Pam Krone

Resources

These information resources provide background information and additional information to help you have a more thorough understanding of this topic. We encourage presenters to view each one so as to be better prepared for your presentation.

Biodegradable Plastic Mulch And Suitability For Sustainable And Organic Agriculture https://ag.tennessee.edu/biodegradablemulch/Documents/Biodegradable-Plastic-Mulch-And-Suitability-for-Sustainable-and-Organic-Agriculture.pdf

Biodegradable Mulch Film for Organic Production Systems https://ag.tennessee.edu/biodegradablemulch/Documents/BDM_for_organic_production_rev_5Apr2016.pdf

Biodegradable Mulch Products https://ag.tennessee.edu/biodegradablemulch/Pages/biomulchprojects.aspx

Glossary of terms associated with biodegradable mulches for specialty crops https://ag.tennessee.edu/biodegradablemulch/Documents/BDM_glossary_May2015.pdf

Impact of Biodegradable Plastic Mulch on Specialty Crop Production

https://ag.tennessee.edu/biodegradablemulch/Documents/BDM%20for%20crops-research%20summary.pdf

Video - An Introduction to "Performance and Adoptability of Biodegradable Plastic Mulch for Sustainable Specialty Crop Production https://www.youtube.com/embed/B1GGXN1d0aw

Video – Plastic mulches: Is it worth it? https://www.youtube.com/watch?v=W5J-P_32MGQ