

## SOIL-BIODEGRADABLE PLASTIC MULCH: SHOULD YOU MAKE THE SWITCH?

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Something important for you to consider: your use of plastic mulch in vegetable production. You’ve no doubt heard about biodegradable mulch, but possibly not so great things. Here are some important questions you may have, and some real answers.

### 1. Can plastic mulch actually “degrade?” Yes, and No.

#### First, the NO.

Degradation of plastic caused by sunlight, heat, moisture, and mechanical stress results in ever-smaller fragments of plastic, ultimately becoming what are called “microplastics.” It’s a disturbing and inescapable fact that plastics (non-biodegradable) are changing the planet for the worse.

#### Now for the YES!

Degradation of plastic by microorganisms, known as biodegradation, is very much a real thing, provided the plastic is made of the polymers that microbes can consume. Soil-biodegradable plastic mulch (BDM) breaks down into CO<sub>2</sub>, water, and microbial biomass.

### 2. How do yields on BDM compare to yields on polyethylene (PE) mulch materials?

Table 1. Crop production with BDM.

Crop	Yield		Weed Control
	vs. Bare ground	vs. PE	vs. PE
Broccoli	+ <sup>1</sup>		
Cucumber	+	=	=
Eggplant	+	=	-
Lettuce		-= <sup>2</sup>	
Melon	+	+=	NR
Pepper	=	=	-
Raspberry	+	=	=
Strawberry	+	-=+ <sup>2</sup>	-
Sweet Corn	+	-=	-
Sweet Potato	+	+=	+
Tomato	+	=	NR
Zucchini		=	

<sup>1</sup> + BDM performed better; = BDM performed equivalent to; - BDM did not perform as well; empty cell not measured.

<sup>2</sup> Reports provide variable results.

Adapted from: Cowan and Miles, 2018

### 3. Can it be applied in the field just like PE mulch?

Yes, more or less BUT three caveats:

- a. It is more delicate than PE, so it has to be handled a little more gently.
- a. If it does get damaged while laying it down, decomposition will be accelerated.
- b. MOST IMPORTANT- it should not be applied as tightly as PE mulch because it continues to tighten as the weather warms. If it is installed too tightly at first, it will split as it tightens up, and this will allow early summer weeds to take over.

### 4. Will last year's mulch bits disappear by the time I am prepping beds this coming year?

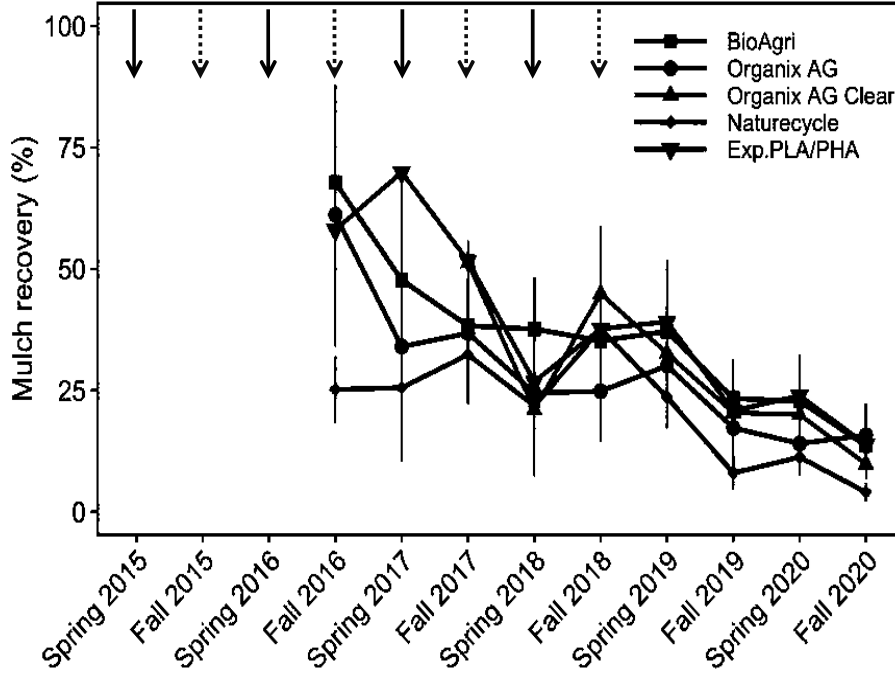


Fig. 1 Percent recovery of mulch fragments collected from the field from 2016 to 2020. New mulch films were laid every spring from 2015 to 2018, indicated by solid black arrows. The plots were rototilled twice a year from 2016 to 2018, once in fall before collecting samples, indicated by dotted arrows, and a second time in spring after collecting samples, then plots were left undisturbed until 2020.

Visual assessments of macroscopic BDM fragments (>2.36 mm) show that after 4 years of annual BDM application from 2015 to 2018 in northwest Washington, mulch recovery from soil in spring 2019 ranged from 23 to 64% of the amount applied, indicating there was no accumulation of mulch fragments in the soil even after repeated applications ([Ghimire et al., 2020](#)). Recovery further decreased to 4-16% two years after the final mulch incorporation in fall 2020 ([Griffin-LaHue et al., 2022](#)). Only paper BDMs (e.g. Weed Guard Plus) showed 100% biodegradation within the timespan of this study, but the conclusion from the study was that BDMs are degrading and do not accumulate in soil after repeated use.

### 5. Is BDM allowed in certified organic system?

No, at this time. For reasons, see the box on the right. But paper mulch such as WeedGuardPlus is allowed.

USDA National Organic Program Rules  
Biodegradable biobased mulch film was added to the list of allowed substances in October 2014. However, it MUST:

- be 100% biobased (ASTM D6866);
- be produced without use of synthetic polymers (minor additives such as colorants and processing aids not required to be biobased);
- be produced without organisms or feedstock derived from excluded methods (i.e., synthetic or GMO);
- meet compostability specifications (ASTM D6400, ASTM D6868, EN 13432, EN 14995, or ISO 17088); and
- reach ≥ 90% degradation in soil within 2 years (ISO 17556 or ASTM D5988)

## 6. Can farmers save money by replacing polyethylene mulch with BDM?

Here is what Margarita Velandia, Professor of Ag Economics at University of Tennessee says:

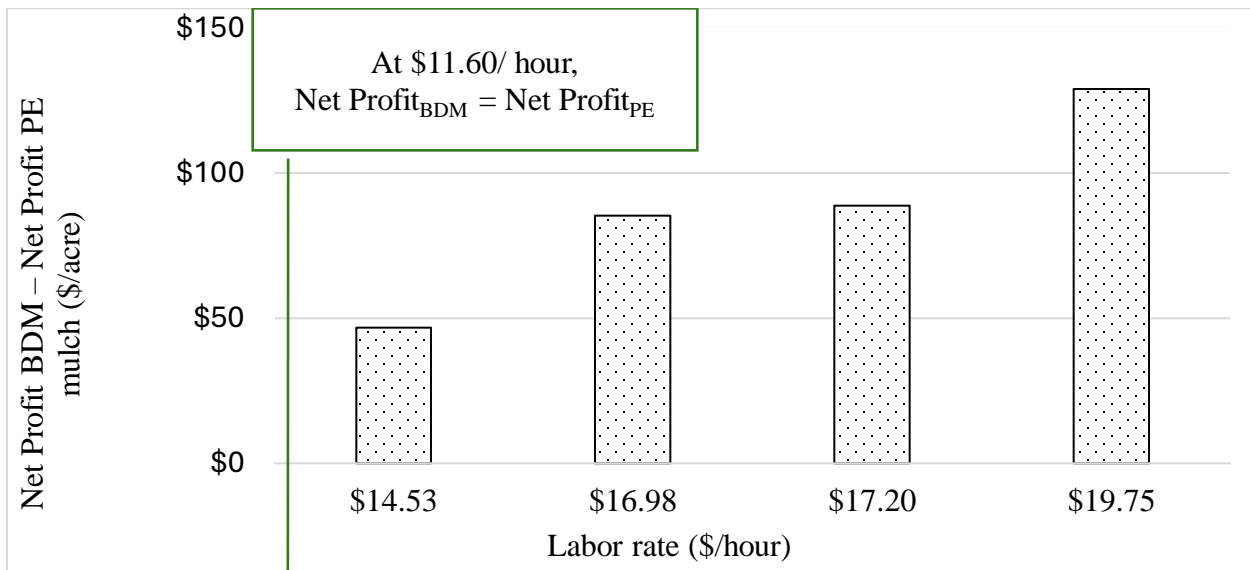
### Changes Associated with Adopting BDM

Category	Assumption	Details
Additional Cost	\$190.00	- BDM material cost: \$190.00
Reduced Income	\$0	- Assumes no changes in prices or yields.

Category	Value	Details
Additional Income	\$0	- Assumes no changes in prices or yields.
Reduced Costs	\$278.83	- Labor savings: \$270.90
		- Disposal savings: \$7.93

- Total Additional Cost + Reduced Income: \$190.00
- Total Additional Income + Reduced Cost: \$278.83
- **Net Profit Change (B-A): \$88.83**

### Sensitivity Analysis: Labor rate



## 7. What is the impact of soil-biodegradable plastic mulch (BDM) on soil health?

Recent studies indicate that BDM does not negatively impact soil health; instead, it may offer some positive effects.

- Carbon degradation: When BDM is broken down by soil microbes:
  - At least 90% of the carbon is converted into CO<sub>2</sub> and methane.
  - Approximately 10% of the carbon is incorporated into the microbial biomass, potentially enriching soil microbial communities.
- Additive Release: During biodegradation, additives such as fillers and plasticizers may be released.
  - Although this process is expected, concerns exist regarding potential environmental threats from nonbiodegradable additives like carbon black. Such

concerns exist for traditional polyethene mulch too.

- Regulatory standards: Standards such as EN17033 and ASTM D6400 ensure that BDM contains:
  - Minimal concentrations of heavy metals and hazardous substances.
  - These standards aim to prevent the introduction of harmful materials into the environment.
- Current research suggests that BDM is safe for soils and its impact on soil health is comparable to polyethylene mulch.
- Studies have not identified significant negative effects of BDM on soil properties or microbial communities.

### **8. What are the common experiences of the growers using PE and BDM in Connecticut and Northeast U.S.?**

- PE mulch leaves more fragments in the field than BDM in long run
- The purchasing cost of BDM is greater than PE, so BDM appears to be expensive in the beginning of the growing season, but overall BDM is cheaper after accounting for removal and disposal costs
- Growers can prepare the field for cover crops at the end of the season when the crop is grown with BDM; the mulch is disked/harrowed in after the drip tape is removed, which does not require much extra field work. But in years with wet Fall, cover crops are delayed or cannot be planted when PE mulch is used
- Even with mulch deterioration in the later season, no/minimal weed growth occurs
- Some growers shared experience of mulch adhesion with cantaloupe, but has not affected marketability of crops
- Removal of PE mulch and picking up fragments at the end of the season is the least liked job of growers
- Weed control and yield is comparable between BDM and PE mulch
- Growers do not have any concern with BDM fragments after incorporation in the field as their observation is that BDM degrades in a couple of years

