Use of Biodegradable Plastic Mulches as an Alternative to Polyethylene Mulch in Day-Neutral Strawberry



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Mulches in Agriculture

- Mulches are **physical coverings** placed on the soil surface
- Applied for **weed management**, **modification of soil temperature**, **reduction of soil evaporation**, **soil protection**, and overall **promotion of crop growth**
- May be made from natural or synthetic materials

What is a Biodegradable Mulch (BDM)?

- **BDM → <u>B</u>io<u>D</u>egradable <u>M</u>ulch**
  - **Paper** or **plastic**
  - **Engineered to biodegrade** in soils upon incorporation
  - Plastic BDMs manufactured with different **feedstocks** and **additives** compared to **nondegradable polyethylene (PE)** mulches
  - Should achieve **≥ 90% biodegradation** in laboratory-based soil tests within two years or less due to microbial activities and in accordance with **ASTM D5988-18** and **EN 17033**

Life of a BDM

Manufacturing

Field Application

UV Radiation

Weathering / Disintegration

Fragmentation & Biodegradation by Microorganisms

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Why Consider a BDM?

Perceived to be a more **sustainable technology** and may:

- Provide the **same horticultural benefits** as PE-based mulches
- **Reduce labor** and **costs associated with mulch removal**
- Promote **on-farm efficiencies**
- **Reduce plastic waste generation**

Mounting Concerns over Plastics

Plastics in Agriculture*


Image: iStockphoto.com/Gannet77


Image: D. Low, 2014

- US agriculture uses **~1 billion pounds** of plastics annually
- Most mulch is **stockpiled or landfilled**; sometimes soil incorporated or burned
- **Less than 10% recycled**
- **Waste management challenges**

*Estimates provided by G. Jones, SWIX

Research with BDMs in Washington

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Plastic Biodegradable Mulches Reduce Weeds and Promote Crop Growth in Day-neutral Strawberry in Western Washington

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Suitability of Biodegradable Plastic Mulches for Organic and Sustainable Agricultural Production Systems

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- **Vegetables (Dr. Miles)**
- **Day-neutral strawberry**
- **Raspberry**

Washington State University

Objectives

Evaluate commercial **biodegradable mulches (BDM)** in comparison with standard **black PE mulch** and **bare ground cultivation** in **spring-** and **fall-planted** day-neutral strawberry grown in northwestern Washington

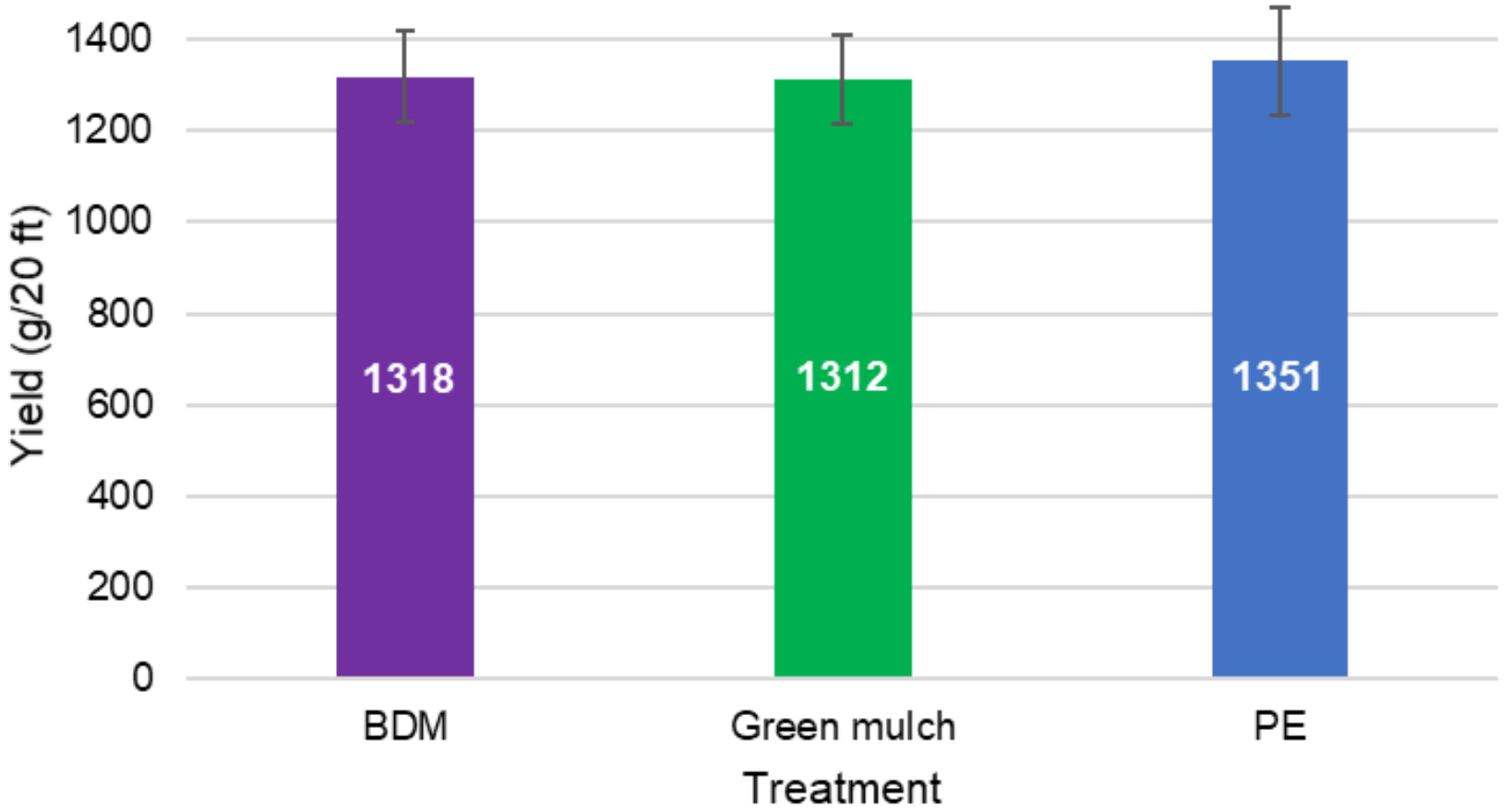
Experiment 1:
Bareroot, Spring-Planted 'Albion' and 'Seascape'

		Albion				Seascape			
		Marketable yield/plot (g)[z]		Marketable fruit number/plot		Marketable yield/plot (g)		Marketable fruit number/plot	
Treatment		2014	2015	2014	2015	2014	2015	2014	2015
Bio360	Biodegradable	253 a[y]	181 a	19 a	15 ab	311 ab	190 b	32	18 b
WeedGuardPlus	Biodegradable	259 a	137.5 b	17 a	11 c	316 ab	144 c	30	13 c
Exp. Prototype	Biodegradable	281 a	181.9 a	20 a	14 b	340 a	202 b	32	18 b
Plastic (PE)		295 a	200.7 a	22 a	17 a	322 ab	239 a	32	22 a
Bare ground (control)		126 b	80.0 c	9 b	6 d	257 b	96 d	25	8 d
P-value		<0.0001	<0.0001	<0.0001	<0.0001	0.05	<0.0001	0.47	<0.0001

[z]Marketable yield and fruit number determined from annual means of harvested fruit from 64 ft^2 subplots.
[y]Means with the same letter within a column are not different due to treatment at α = 0.05; a Tukey-Kramer adjustment was used for multiple comparisons.

Source: DeVetter et al., 2017; *HortScience*

Experiment 2:
Fall-Planted 'Albion' Plugs



Project in progress and will be repeated 2019/2020

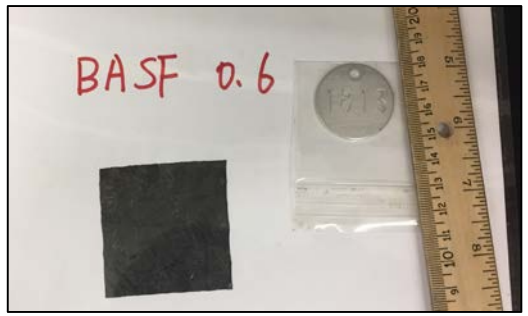
Things to Remember about BDMs…

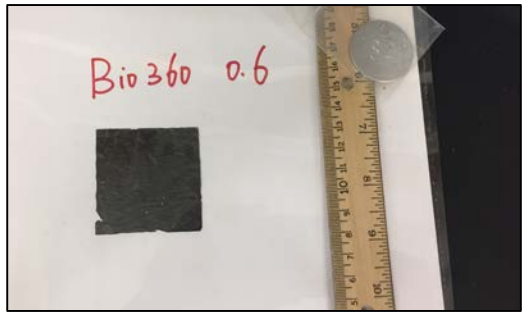
- Not all BDMs are created equal
- **BDMs vary** based in their feedstocks, types of additives, thickness, and manufacturing processes
- This creates **very different products** that can **function very differently** in fields
- **Growing conditions** are diverse
- **Not all BDMs have demonstrated complete biodegradation in soils**

In-Soil Biodegradation

Buried BDMs 2 inches below the soil surface on April 20, 2018

1.5 years





Samples removed Oct. 23, 2019

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Oxo-Degradable Plastics

Conventional polymers with chemicals added to accelerate oxidation and fragmentation with exposure to UV light and/or heat, and oxygen

3 years after mulch application, Everett, WA. Photo by Andy Bary.

Sometimes erroneously labeled "oxo-biodegradable" or "biodegradable"

BDMs in Organic Agriculture

- In Oct. 2014, the National Organic Program (NOP) passed a final rule **adding biodegradable biobased mulch** film to their list of **allowed substances**
- Yet, BDMs **must meet specifications** of the rule
- **Currently, no products meet these requirements (other than paper mulch)**

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Thank you!
Any Questions?

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