

# Biodegradable Plastic Mulch Provided Weed Control, Yield, and Quality of Pie Pumpkin Comparable to Polyethylene Mulch

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## INTRODUCTION

- Mulching reduces weed pressure, moderates soil temperature, conserves soil moisture and results in higher crop yield.
- Removing polyethylene (PE) mulch from the field is costly; in most cases PE is not recyclable and can be a source of pollution.



**Fig. 1.** Stockpiling of PE mulch by farmers after use.  
 Photo source: Greg Scullin (The Weekly Times, Nov. 13, 2014)

- Mulch that can biodegrade in the field after tillage incorporation without negatively impacting the soil ecosystem would be more sustainable.



**Fig. 2.** Rototilling biodegradable mulch after crop harvest in the field experiment in 2015.

## OBJECTIVES

Compare PE and biodegradable mulches for:

- weed incidence
- pumpkin yield and fruit quality

## MATERIALS AND METHODS

- In 2015, 7 mulch treatments (Table 1) were tested at two experimental field sites.
- Pie pumpkin (*Cucurbita pepo* L. cv. Cinnamon Girl) was the test crop.

### Two experimental field sites:

- Mount Vernon (Washington State University)** Northwestern Research and Extension Center located in the maritime Pacific Northwest with a cool, humid summer and mild winter climate and Skagit silt loam.
- Knoxville (University of Tennessee)** East Tennessee Research and Education Center located in the subtropical southeast with a hot and humid summer climate and Dewey silt loam.

**Table 1.** Mulch treatments in 2015 with biobased content information provided by manufacturers.

Treatment	Key product ingredient(s)	Bio-based %
Bare ground		
BioAgri	Polyesters blends with or without starch	20-25%
Naturecycle	Starch-polyester blend	20%
Exp-PLA/PHA	Ingeo®PLA / Mirel™ amorphous PHA	93.5%
Organix	BASF®ecovio® (PLA <sup>z</sup> + PBAT)	< 10%
Polyethylene (PE)	Polyethyelene	< 1%
WeedGuardPlus	Cellulose	100%

<sup>z</sup> Abbreviations: PCL – poly(caprolactone); PLA - polylactic acid; PBAT – poly(butylene adipate-co-terephthalate); PHA – poly(hydroxyalkanoate).



**Fig. 3.** Overview of biodegradable mulch experiment at WSU Mount Vernon NWREC in 2015.

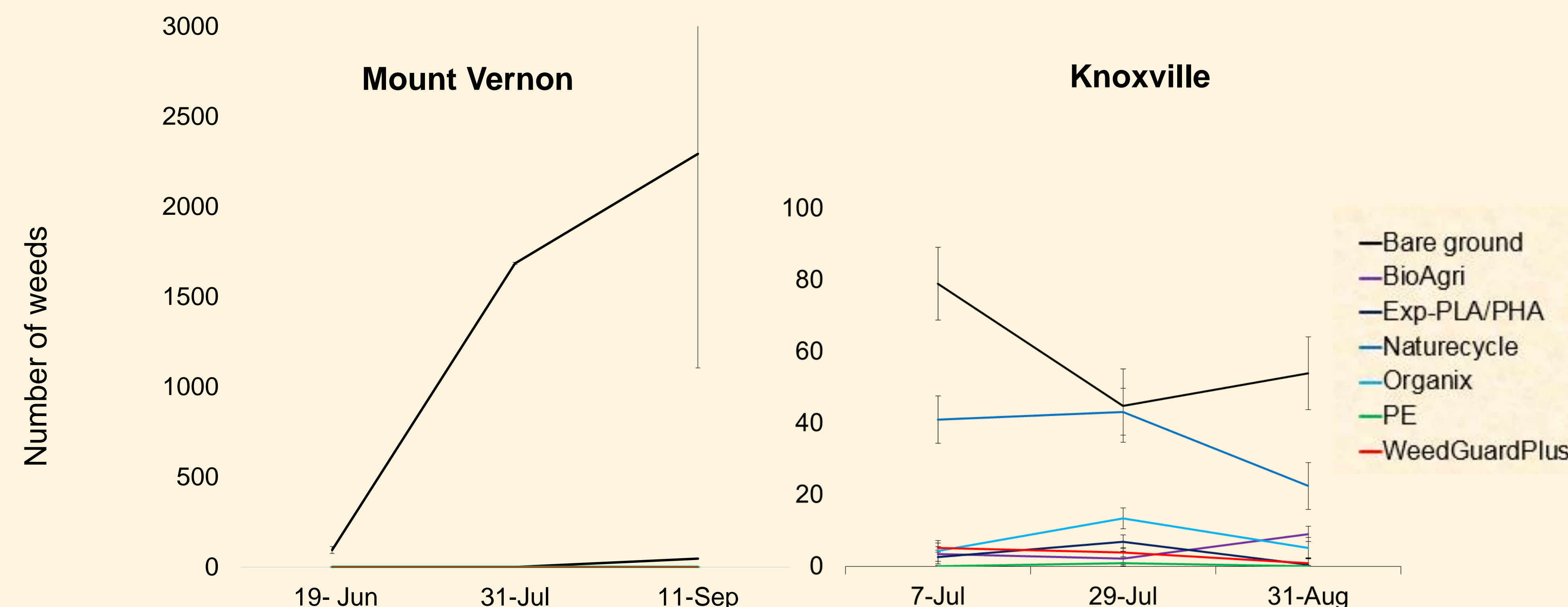


**Fig. 4.** Splits in biodegradable plastic mulch product at the end of the growing season.

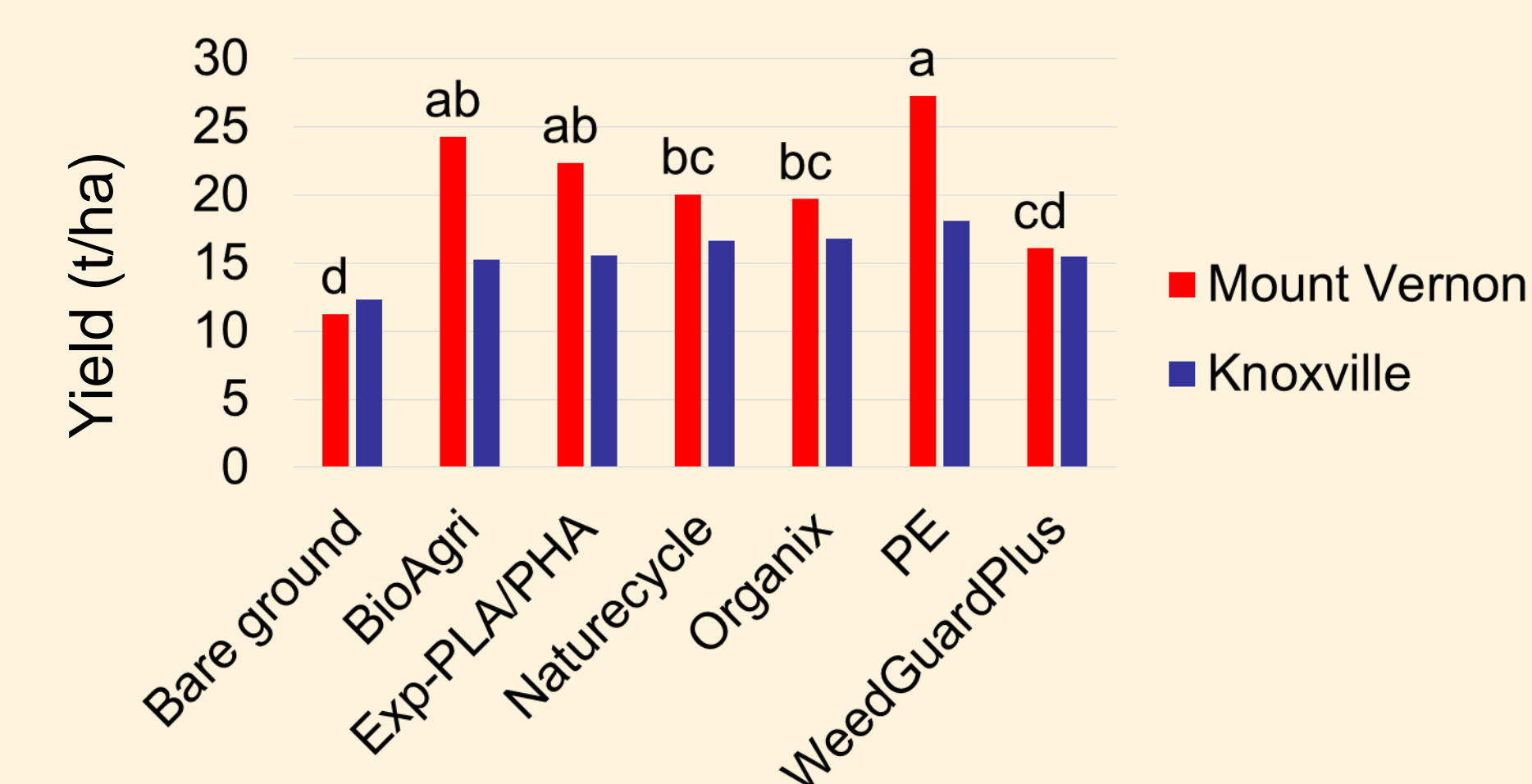
## RESULTS

### Weed control

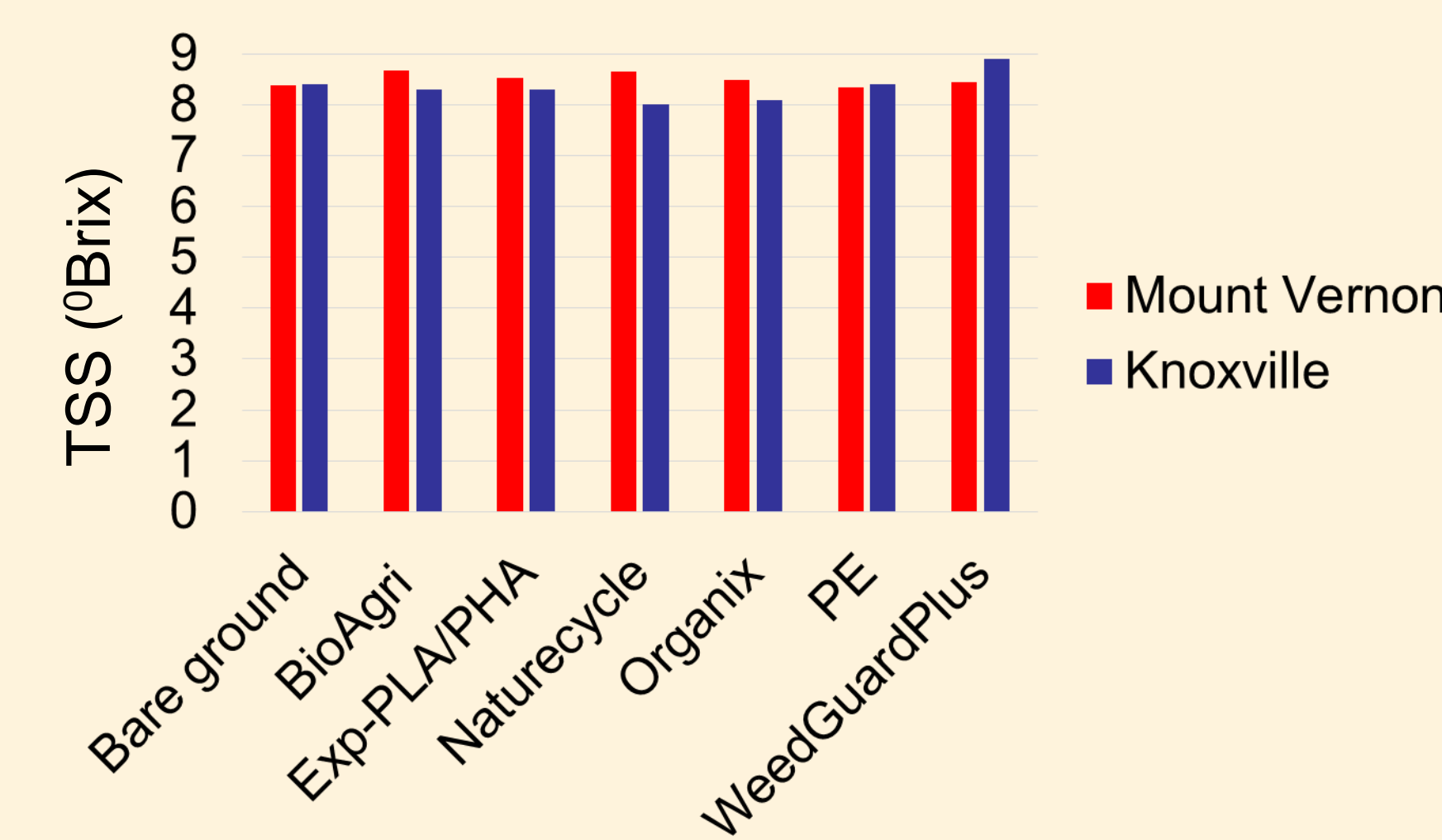
- Mount Vernon:** Number of weeds in the no-mulch treatment increased from transplanting to harvest, however, no weeds were noted in any of the mulch treatments except Naturecycle at 2 weeks prior to harvest (Fig. 5).
- Knoxville:** Number of weeds was higher for the no-mulch treatment and Naturecycle from seeding to harvest compared to other treatments; however, weeds did not affect pumpkin yield and quality in any treatment. (Fig. 5).



**Fig. 5.** Number of weeds in mulch treatments, measured 2 weeks after planting, mid-season, and 2 weeks prior to harvest at Mount Vernon (left) and Knoxville (right) in 2015.



**Fig. 6.** Pumpkin marketable fruit yield (t·ha<sup>-1</sup>) for mulch treatments at Mount Vernon and Knoxville in 2015.



**Fig. 7.** Total soluble solids (TSS, °Brix) of pumpkin fruit for mulch treatments measured at harvest at Mount Vernon and Knoxville in 2015.

### Pumpkin marketable yield

- Mount Vernon:** BioAgri and Exp-PLA/PHA were comparable to PE mulch; no-mulch treatment and WeedGuardPlus were significantly lower; Naturecycle and Organix were intermediate (Fig. 6).
- Knoxville:** did not differ due to treatments (Fig. 6).

### Pumpkin fruit quality

- Both sites:** Total soluble solids (Fig. 7), dry matter, and fruit size at harvest did not differ due to mulch treatment.

## DISCUSSION

Yield differences at Mount Vernon may have been due to the soil temperature:

- At 10 cm depth, temperature tended to be 2 °C lower for the no-mulch treatment (20.3 °C) and 1 °C lower for WeedGuardPlus as compared to PE, BioAgri and Exp-PLA/PHA (21.8 °C – 23.3 °C).
- At Knoxville, soil temperature was relatively high in general (25.3 °C – 26.9 °C) for all treatments.



**Fig. 8.** Hand-harvesting pumpkins from the field experiment at Mount Vernon in 2015.

## CONCLUSION

- Biodegradable plastic mulch provided weed control and pumpkin fruit quality comparable to PE mulch, however, the extent differed by location.
- Fruit yield with BioAgri and Exp-PLA/PHA were comparable to PE mulch at Mount Vernon, whereas there were no difference in fruit yield due to treatment at Knoxville.

## ACKNOWLEDGEMENTS

