To cite these preliminary results, please use:

Jiang, J. (2025) *Preliminary Results for Strawberries based on Research Paper Jiang, J., T. L. Marsh, and E. Belasco. 2025. "Optimizing microplastic pollution in a terrestrial environment: a case for soil-biodegradable mulches." Agricultural and Resource Economics Review.* [Unpublished Results]. Department of Business Economics and Communication, PennWest University. Retrieved from https://github.com/YoYo-JDCE/BDMs-Jiang-Strawberries/tree/main

Table 1 Baseline Coefficients of Production, Cost, Disposal and Plastic Residual Evolution in a Fresh-market Strawberries Production System

Parameters	Name	Values (Strawberries)
Production Function (lb)		
α_0	Crop production under PEMs	18,000 [1]
α_1	Coefficient of production associated with degradation rate	1[2]
α_2	Coefficient of production associated with plastic residue	0.1[2]
α_{11}	Coefficient of production cost associated with degradation rate squared term	0.005[2]
α_{22}	Coefficient of production cost associated with plastic residue squared term	5[2]
Crop Price ($/lb)		
P_t	Tomato price	1.01
Production Cost ($)		
ν_0	Production Total Cost	18,621.39[1]
ν_1	Coefficient of production cost associated with degradation rate	10[3]
Disposed Plastic Mulch Waste (lb)		
β_1	Total amount of the used plastic mulch during period *t* by grower *i*	1237.56 [4]
β_{12}	Coefficient of disposed plastic mulch associated with the interaction of the grower's disposal decision and the mulch's degradation rate	0.5[3]
χ_0	Effort coefficient when close to 0% mulches removed from the farmland	0.2[3]

χ_1	The parameter used to determine the effort coefficient increase rate as the portion of mulch removed from the farmland increases	0.8[3]
Plastic Residue in the Farmland Soil (lb)		
η_0	Initial plastic residue in the farmland soil	3.2[2,3]
η_1	Coefficient of plastic residue associated with degradation rate	0.5[3]
η_2	Coefficient of plastic residue associated with plastic pollutant	0.1[3]
η_3	Coefficient of plastic residue associated with the grower's disposal decision	3.2[3]
η_4	A base level of residue from PE (or BDM for that matter) whether the mulch goes to a landfill	0.05[3]
η_{13}	Coefficient of plastic residue associated with the interaction of the grower's disposal decision and the mulch's degradation rate	0.5[3]

[1] The following values of parameters are obtained from "2015 Strawberry Budget Program Conventional in North Carolina".
α_0 representing the crop production under the PEMs is 18000lb/acre.
β_1 denoting the total amount of the used plastic mulch used during period *t* by grower *i*. The parameter value is obtained from Rysin (2015).
v_0 representing the production cost not associated with the plastic mulch used by grower *i* is equal to \$18621.39.
[2] Values are calibrated based on Rysin (2015) and Jiang et al (1998). The elasticity of soil plastic residue in affecting production is less than -0.028% when plastic pollutant levels are 3.2 lb. Following their work, we assume parameter values, $\alpha_1, \alpha_2, \alpha_{11}, \alpha_{22}$ that result in an elasticity of less than 0.028%. While there is no study quantifying the relationship between mulch degradation rate and cost, we assume parameter values, v_1, and conduct sensitivity analysis to check the robustness of the results.
[3] The remaining parameter values are assumed to satisfy the first-order conditions and the functional form assumptions in section 3.1. Due to the lack of empirical studies providing values for these parameters, we conduct sensitivity analysis using different parameter values to check the robustness of the results. This paper presents sensitivity analysis for key parameters; a complete sensitivity analysis is available upon request.
4 We followed Galinato et al (2012)'s budget to calculate the weight of disposed plastic mulches based on mulch usage studied by Poling et al (2005).

Plastic Mulch Weight Calculator, Disposal (Pounds)

45,002	Square feet per acre
5	Between-row spacing (feet)
2,000	Length of plastic mulch (feet per roll)
55	Initial weight of plastic mulch (lbs per roll)
5	Assumed no. of times of increase in weight due to dirt*
1237.56	**Pounds of plastic mulch disposed**

Table 2 Optimal Steady-state Disposal Method, Degradation Rate and Accumulated Plastic Pollutant in the Farmland Soil[1]

	Disposal Method	Degradation Rate (δ_{it})	Plastic Pollutant in the Farmland Soil (lb.) (S_{it})	Plastic Pollutant in the Landfill from the Farm (lb.) ($h_t(.)$)
Grower Optimum (Baseline)	Disposal Facility	0%	0.06	∞
Crop price (P_t) raises 50%	Disposal Facility	0%	0.06	∞
The coefficient of production cost associated with degradation rate (ν_1) increases 50%	Disposal Facility	0%	0.06	∞
The coefficient of production measuring the reduction associated with the plastic residual in the farmland soil (α_{22}) rescaled to -500[1]	Disposal Facility	0%	0.06	∞

[1]Gao et al. (2019) reported that when the residual plastic mulch is over 214lb per acre, then the crop yield would have a significant decrease. To incorporate the results from this study, in our comparative statistics analysis, we rescaled the coefficient $\boldsymbol{\alpha_{22}}$ to -500 in order to have a production function that will have significant yield decreases at 214 lb of mulch residue.

Table 3 Analysis of the Impact of Landfill Tipping Fee

	Projected Landfill Tipping fee ($/lb) ($w$)	Disposal Method	Degradation Rate (δ_{it})	Plastic Pollutant in the Farmland Soil (lb.) (S_{it})	Plastic Pollutant in the Landfill from

[1] While our analysis applied a Monte Carlo simulation with up to 1,000 periods to identify the steady state, it converges to the steady state rapidly (see appendix for more details). Nevertheless, these results are conditional on the parameters and information applied in the current illustrative analysis, and should be updated with additional and new information in future research.

					the Farm (lb.) ($h_t(.)$)
Threshold	0.069	Disposal facility/In soil	0%	3.61	∞
In 5 years	0.052	Disposal facility	0%	0.06	∞
In 10 years	0.066	Disposal facility	0%	0.06	0
In 20 years	0.105	In soil	0%	3.61	0
In 20 years and α_{22} rescaled to -500	0.105	In soil	100%	3.06	0
In 20 years and Crop price raises 39%	0.105	In Soil	61%	3.27	0

Table 5 Optimal Steady-state Disposal Method, under the Corrective Tax

	Disposal Method	Degradation Rate (δ_{it})	Plastic Pollutant in the Farmland Soil (lb.) (S_{it})	Optimal Tax ($/lb) ($\tau_{i,t}$)	Plastic Pollutant in the Landfill from the Farm (lb) ($h_t(.,z_{it})$)
Social Planner Optimum (Baseline)	In soil	96%	3.08	6.64	0
Social Planner Optimum (Crop Price decreases 50%)	In soil	96%	3.08	13.43	0
Social Planner Optimum (The coefficient of Production cost associated with degradation rate increases 50%)	In soil	96%	3.08	16.75	0