Quarterly Progress Report

December 1, 2025 to March 1, 2026

PROJECT TITLE: Quantifying and Minimizing the Environmental Impact of Agricultural Plastic Mulch Film Burning

PRINCIPAL INVESTIGATOR(S):
Principal Investigator: Yang Wang, Ph.D., Assistant Professor, Department of Chemical, Environmental and Materials Engineering, University of Miami, yangwang@miami.edu
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Graduate Student: Kazi Tahsina Habib, Department of Environmental Engineering Sciences, University of Florida, kazitahsinahabib@ufl.edu
Undergraduate Student: Courtni Spencer, Department of Chemical, Environmental and Materials Engineering, University of Miami, cys25@miami.edu

PROJECT WEBSITE:
https://pmtl.coe.miami.edu/research/hinkleycenter/index.html

Work Accomplished During This Reporting Period

1. Complete the burning of agricultural plastics in the tube furnace

The burning of agricultural plastic in the tube furnace was completed during this period. The burning was performed using two types of field-collected used plastic mulch film (one being double layer with white color, and the other being single layer with black color, both obtained from Berry Global Inc.). The plastic samples were burned under controlled temperatures between 550 and 800 °C. The burning residues were shipped to the University of Florida for microplastic analysis. Preliminary findings include:

- Higher carbon monoxide (CO) emissions at lower temperatures, indicating incomplete combustion. This is feature is shown in **Fig. 1**, where a lower temperature resulted in a lower modified combustion efficiency (MCE), which is calculated by MCE = [CO]/([CO]+[CO_2]), where [CO] and [CO_2] are the mixing ratios of CO and CO_2 measured by the gas analyzer.
- The burning of black plastic mulch has a higher MCE, likely due to its thin single layer structure that can facilitate the transport of O_2 for more efficient burning.
- Overall, the burning of black plastic mulch samples has a higher emission factor for particulate matter (PM) than the white plastic mulch (**Fig. 2**), likely due to the more efficient burning of the plastic due to its thin and elastic texture. This likely suggests that white plastic mulch, although being thicker, generated less amounts of PM during its combustion. We will conduct more analysis of the other types of pollutants (trace gases and microplastics) to compare the two types of plastics.
- We collected the burn residue samples for each combustion condition (**Fig. 3**), and the residue samples will be shipped to Dr. Sungyoon Jung's group for microplastics analysis.

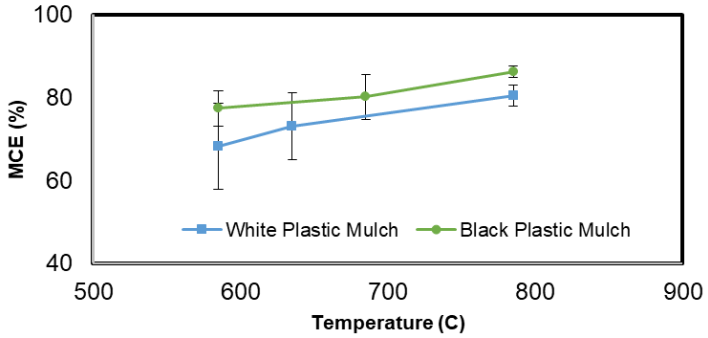

Fig. 1. Modified combustion efficiency (MCE) as a function of burn temperature for the plastic mulch samples.

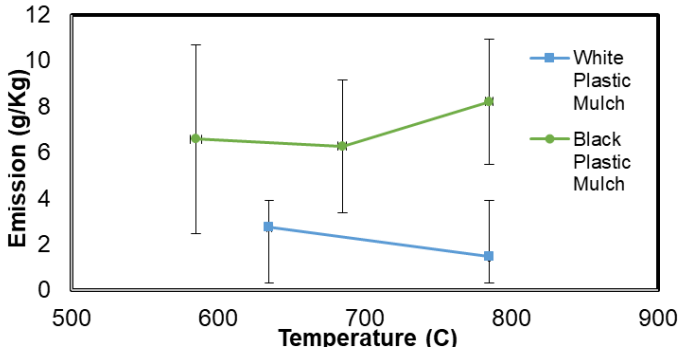

Fig. 2. Emission factors of particulate matter (PM) as a function of burn temperature for the plastic mulch samples.

Fig. 3. Plastic burning residues for microplastic analysis

2. Presented the work in the poster session at the SWANA FL Winter Conference & Hinkley Center Research Forum

The Ph.D. student working on this project, Amir Sharafudin, presented the preliminary results of this work in the poster session of the SWANA FL Winter Conference & Hinkley Center Research Forum. He collected comments and suggestions on this project, especially regarding the analysis of data and improvements to the combustion system.

3. Hosted a meeting discussion with the UF Gulf Coast Research and Education Center

We also hosted a virtual meeting with the UF Gulf Coast Research and Education Center, which conducts agricultural research, specializing in breeding strawberries, tomatoes, and ornamental plants. The scientists showed interest in our project, but due to logistics concerns, we could not collect soil samples or conduct burn measurements this year. We will focus on the laboratory measurement of plastic burning for the current year.

Work Planned for the Next Reporting Period

In the next reporting period, we complete the open burning combustion experiments and pollutant analysis. The detailed tasks include the following:

- Complete controlled open-burn experiments using liquid fuels (ethanol, gasoline, lighter fluid) and Flame-torch-assisted burns (methane/propane).
- Complete full analysis of PM mass, size distribution, OC/EC, CO/CO_2/NOx/SOx.
- Continue microplastic identification using stereomicroscopy, SEM-EDS, and Py-GC/MS.
- Compare emission factors against EPA NAAQS and FDEP Soil Cleanup Target Levels.
- Begin preparing emission factor tables for PM, gases, metals, and microplastics.

Metrics

Personnel involved in this quarter:

Name	Role	Department	Institution
Yang Wang	Assistant Professor	Department of Chemical, Environmental and Materials Engineering	University of Miami
Sungyoon Jung	Assistant Professor	Department of Environmental Engineering Sciences	University of Florida
Amir Sharafudin	Graduate Student	Department of Chemical, Environmental and Materials Engineering	University of Miami
Kazi Tahsina Habib	Graduate Student	Department of Environmental Engineering Sciences	University of Florida
Courtni Spencer	Undergraduate Student	Department of Chemical, Environmental and Materials Engineering	University of Miami

Technical Awareness Group (TAG) list

Name	Affiliation	Sector
Gene Jones	CEO of Southern Waste Information eXchange	Private
Sam Sugerman	Sustainability Manager in agricultural sector	Private
Samir Elmir	Division Director, Florida Department of Health Miami-Dade Environmental Public Health and Engineering	Public
Nicholas Ciancio	Chief of Resilience Engineering & Environmental Compliance, Department of Solid Waste Management	Public
Elizabeth Kromhout	Environmental Administrator, Florida Department of Environmental Protection	Public
Linda Braam	Engineer, Lee County Solid Waste Department	Public
Lisa Wasko DeVetter	Associate Professor, Department of Horticulture, Washington State University	Researcher
Marwa El-Sayed	Associate Professor, Department of Civil Engineering, Embry-Riddle Aeronautical University	Researcher
Jiannan Chen	Assistant Professor, Department of Civil, Environmental, and Construction Engineering, University of Central Florida	Researcher