Research & Development Program
New York State Pollution Prevention Institute

Greenhouse Gas Impacts of Pathways for Utilization of Waste Food Materials in New York State.

This study identifies alternative treatments for food materials at every stage of the farm-to-fork spectrum

Background Description

According to estimates from the National Institutes of Health, 40% of food produced for human consumption in the U.S. ends up in the waste stream.[1] Along with economic and social impacts, disposal of food waste has many important environmental consequences. Alternative pathways are being developed to treat food waste beyond conventional methods such as landfilling. A number of prior studies have compared the climate change impacts of alternative treatments for food waste as part of municipal solid waste (MSWFW), however, resources leave the food supply chain (FSC) as wastes at every stage of the farm-to-fork spectrum. These FSC resources often have unique characteristics as well as unique treatment options.

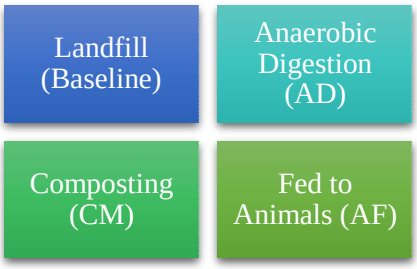
A US industry group study has estimated that industrial and commercial sources constitute 66% of disposed food waste.[1] FSC resources generated at the industrial level (i.e., food processing plants) include by-products or rejects from food manufacturing processes. In the commercial sector, retail establishments may generate unique waste streams from different operations within a store or at different types of stores. Food preparation waste or uneaten food (post-consumer waste) at restaurants or institutions is another form of commercial food waste.

Finding a Solution

To choose among available options for FSC treatment, data on the climate change impacts is important to inform a balance of environmental, social and economic considerations.

An open source model for the climate change impacts for different treatment options has been developed, based upon physical characteristics of representative food materials generated at different stages of the FSC, as shown in Table 1 on page 2.

Each FSC resource was evaluated to quantify the greenhouse gas emissions (in kg CO_2 equivalent per ton processed) associated with four treatment pathways:



Climate change impacts were evaluated using a life cycle assessment methodology, combined with in-house measured physical and chemical properties, including total solids, total volatile solids, bio-methane potential, nitrogen, potassium and phosphorous content, and fat, protein and carbohydrate composition.

Interpreting Results

The results of the model are illustrated in Chart 1, where the colored bars represent the mean GHG emissions for the four treatment pathways for each FSC resource studied.

Jacqueline H. Ebner, October 2016

[1] Gunders, D., 2012. Wasted: How America Is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill. Natural Resources Defense Council Issue Paper.

[1] BSR, Food Waste: Tier 1 Assessment, March 2012, http://www.foodwastealliance.org/wp-content/uploads/2013/06/FWRA_BSR_Tier1_FINAL.pdf

Error bars indicate uncertainty resulting from a Monte Carlo analysis that varied parameters within the model. Each treatment pathway showed a range of impacts across FSC resources. The landfill pathway showed the highest range, varying from a mean value of 3115 kg CO_2e/t for baked goods to 111 kgCO_2e/t for salad mix. Compost treatment pathway results ranged from 156 kgCO_2e/t for baked goods to 61 kgCO_2e/t for salad mix. For the AD treatment pathway, results ranged from a net negative (or avoided) impact of 282 kgCO_2e/t for baked goods to an impact of 8 kgCO_2e/t for apple pomace. Using FSC resources to feed animals generally had a net negative impact as it displaced the impacts of cultivating grain for animal feed.

For all FSC resources, the greatest environmental benefit is achieved by diverting the material from landfill disposal, regardless of the alternative option selected. However, the magnitude of the GHG reduction is strongly dependent on the specific properties of the food supply chain material.

Chart 1

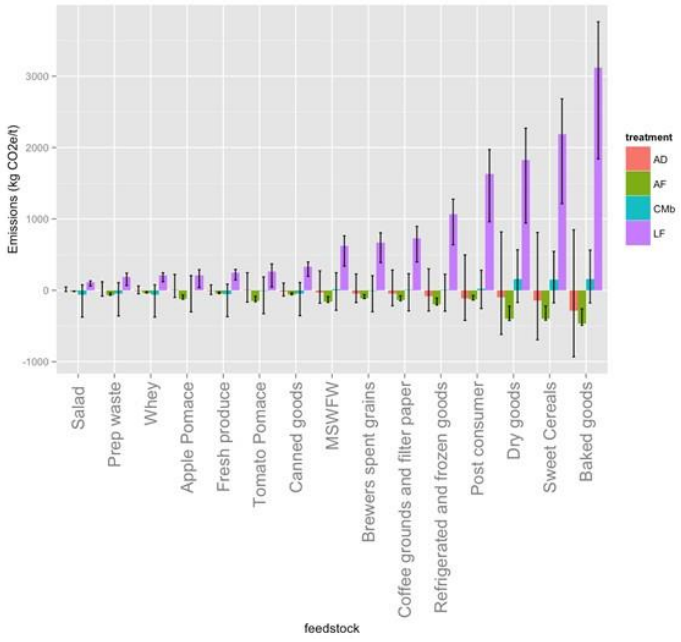


Table 1

FSC resource	Description
MSW FW	Food waste constituent of municipal solid waste (reference).
Apple pomace	By-product of apple juice extraction.
Brewer's spent grains (wet)	By-product of brewing industry consisting mostly of barley.
Grape pomace	The solid remains after pressing, may contain skins, pulp, etc.
Tomato pomace	By-product of tomato food processing (juice, ketchup, etc.).
Whey	By-product of yogurt or cheese making.
Baked goods	Based upon samples containing stale bagels, muffins and donuts.
Canned goods	Various foodstuffs in damaged cans removed from the shelf.

FSC resource	Description
Coffee grounds and filter paper	Spent coffee grounds (medium roast) and coffee filter paper.
Dry goods	Assorted grains removed from the shelf (rice, oatmeal, etc.).
Salad	Rotting lettuce and bagged lettuce mixes.
Sweet cereals	Assorted breakfast cereals removed from the shelf.
Fresh produce	50% rotting lettuce and 50% other rotting fruits & vegetables.
Refrigerated and frozen dairy	Assorted yogurts and frozen desserts.
Post-consumer	Cafeteria plate waste.
Prep waste	Kitchen preparation waste with multiple components.

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