How Food Waste Contributes to Greenhouse Gases

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Introduction

In the 2011 Food and Agriculture Organization (FAO) of the UN assessment of global food losses and waste estimated that each year, one-third of all food produced in the world for human consumption never reached the consumer's table[1]. Aside from the impact this has on the global economy and food security, and a waste of all the natural resources used for growing, processing, packaging, transporting and marketing food, but it also leads to increased GHG emissions from the food that is not consumed by the end-user. If this food waste goes to the landfill and rots, its nutrients will not return to the ecosystem and it produces methane (CH_4)—a greenhouse gas even more potent than carbon dioxide (CO_2)[2].

Source of Food Waste

Approximately 185 million tons of food loss and waste is generated in North America annually. This estimate encompasses all stages of the food supply chain, including the pre-harvest and consumer stages[2].

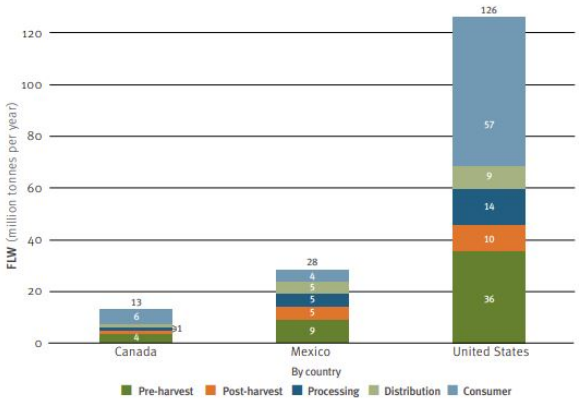

Figure 1. Estimates of Food Loss and Waste (FLW) across the Food Supply Chain in North America[2].

Per capita, food loss and waste (FLW) in the United States averages 415 kg/person/year, economically that is a loss of $278 billion annually[2]. A tremendous financial burden without even considering the environmental impact. These statistic and others led many states to enact policies to reduce food waste including New York State[2,3].

Impact of Food Waste on GHG Emissions

According to the FAO one third of greenhouse emissions globally come from agriculture, and 30% of the food we produce is wasted – about 1.98 billion tons of it a year[4]. If, as a planet, we stopped wasting food altogether, we'd eliminate 6.7% of our total emissions[4]. This means that the contribution of food wastage emissions to global warming is almost equivalent (87%) to global road transport emissions[4]. The total carbon footprint of food waste is approximately 3.3 Gt CO_2 eq. per year globally[4]. According to FAO and Commission for Environmental Cooperation (CEC) studies, if food waste was a country, it would be the third highest emitter of greenhouse gases after the US and China[2,4].

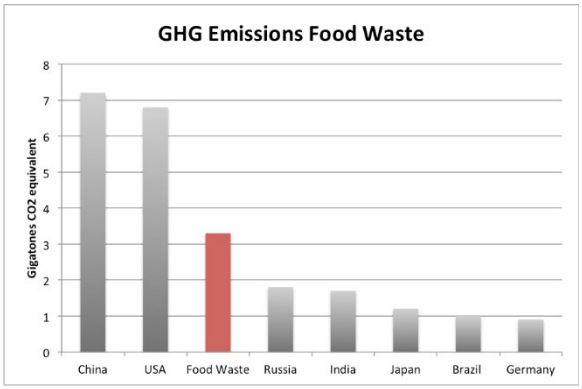

Figure 2. Total GHG emissions of top 8 of countries (year 2005) vs. Food wastage[4].

Food waste decomposing in a landfill will result in the emission of CH_4, CO_2 and N_2O in amounts varying with type of food waste, be it beef, poultry, grains, bread, fruits and vegetables, or dairy products[5,6]. Reducing emissions by these food wastes using available management options is the goal of the EPA's Waste Reduction Model (WARM)[5].

Mitigation Opportunities

Management pathways modeled in WARM estimate streamlined lifecycle GHG emission

factors for food waste from the six organic material types mentioned previously[5]. WARM GHG emission factors are used to compare the net emissions associated with the five material management options[5]:

- Source reduction
- Composting
- Landfilling
- Combustion
- Anaerobic digestion

Each management option presents a minimizing effect on emissions compared with food waste decomposing in a landfill.

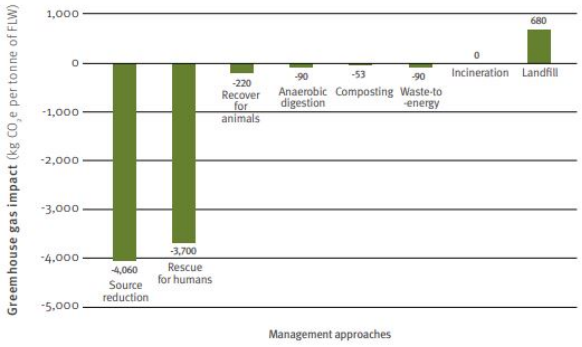

Figure 3. Greenhouse Gas Impacts of Management Approaches to Food Loss and Waste[2].

Next to source reduction, the most promising emission mitigation practice of the five is anaerobic digestion[5,6].

Food Waste in Anaerobic Digesters

Anaerobic Digestion is a process by which organic matter, such as animal waste or wasted food, is broken down by bacteria in the absence of oxygen[7]. There are many benefits to anaerobically digesting food waste. Employing a digester to process food waste aids in state waste diversion goals. Food waste is highly biodegradable, even though additional material is added to the digesters, the end residual will only increase by a small amount[7]. Important reasons that food waste should be anaerobically digested is for capturing the energy content and reducing GHG[6,7].

Farm Opportunities in Processing Food Waste

Farms that use anaerobic digesters as part of a manure processing practices could benefit from the addition of food waste to their digesters. Food waste has much more energy potential than manure[7]. The possible economic benefits to a farm include tipping fees, reduced energy costs due to production of on-site power, additional nutrients recycled and potential carbon credits for accepting the food waste[7].

Farm Challenges in Accepting Food Waste

Farms need to be aware that the added and variable amounts of food waste may upset the digester, bring excess nutrients, and increase storage and hauling. Farms should carefully assess the advantages and disadvantages as they evaluate adding a food waste enterprise.

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