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## Recycling of Coffee By-Products by Composting Regarding Climate Relevant Emissions and Products

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### Abstract

Throughout the world, the agriculture, sanitation and waste management sectors are mainly carried out in isolation, resulting in permanent nutrient drainage and large amounts of greenhouse gas emissions due to inadequate or excessive use of fertilisers. The purpose of this study is to develop an innovative experimental methodology for the sustainable recycling and improved treatment of coffee by-products to produce organic compost, which can be used in agricultural crops including coffee plantations. The methodology will be implemented in a Mill in Costa Rica, due to the current waste management and its potential to reduce GHG emissions during its production cycle. This study investigated the performance of aerobic windrow systems by using coffee by-products and green waste to reduce gaseous emissions. Thereafter a comparison with the current treatment and gaseous emissions at a Coffee Mill in Costa Rica was made. Different composting studies were performed in Germany and in Costa Rica. Temperature, water content, and pH were the key parameters controlled over 35 days and 60 days. Moreover, CH<sub>4</sub> emission rates were quantified by a FTIR and by a portable gas detector device where the emissions were reduced up to 100 times than using the current method at the Mill. It was found that CH<sub>4</sub> emissions could be avoided, following the key parameter for composting and a proper mixture. With this, the reduction of CH<sub>4</sub> emissions at the Mill in Costa Rica could be achieved in the future, providing a circular economy and towards to a reduction in the carbon footprint during the management of the coffee-by-products in the sector.

**Keywords:** greenhouse gases, coffee by-products, coffee pulp, composting, emission rates, methane