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Recycling of coffee by-products by composting regarding climate relevant emissions and products

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Introduction

The coffee sector in Costa Rica has set itself the goal of sustainable management of coffee by-products, incorporating climate change adaptation measures into its practices. Therefore, emissions play an important role in future assessment options for climate change mitigation.

Coffee pulp is the organic waste generated from wet the processing of the fruit, which can become, if not properly managed, a highly polluting waste because it is a major generator of odor, larvae, flies and greenhouse gases emissions such as methane.

The Mill of study, generates about 37,000 tons/year of coffee by-products per harvest (one ton of coffee pulp for every two tons of green coffee processed).

Objectives

- ❖ Enhance the opportunity of compost production from coffee by-products, promoting a circular economy in the coffee industry that incorporates the objectives of the bio-waste strategy and the principles of sustainable agriculture and the reduction of methane emissions

- ➢ Analyze the status quo of one of the coffee by-products, especially with the handling of the pulp in a mill in Costa Rica
- ➢ Development and innovation of an improved technique for the treatment of coffee pulp and the optimization of thermophilic processes by using the coffee pulp and green waste in the production of compost.
- ➢ Contribute to the National Bio economy Strategy
- ➢ Generate an amendment to improve the soil for coffee plantations

Methodology

- 530 tons of coffee pulp and 110 tons of green waste were used for the formation of 35 windrows over a period of 8 weeks.

Coffee cherries harvest

Coffee pulp as by-product

Windrows

Weekly methane emissions measurements

Aerial photo: Improved composting (right), current composting at the Mill (left)

Results: Compost quality indicators

Functional and physical properties

Growth test, microbiological activity, bulk density, temperature and water content

Chemical -agronomical properties

Total and soluble nutrients, organic matter,rotting degree, pH

Table 1: Chemical properties in finished compost

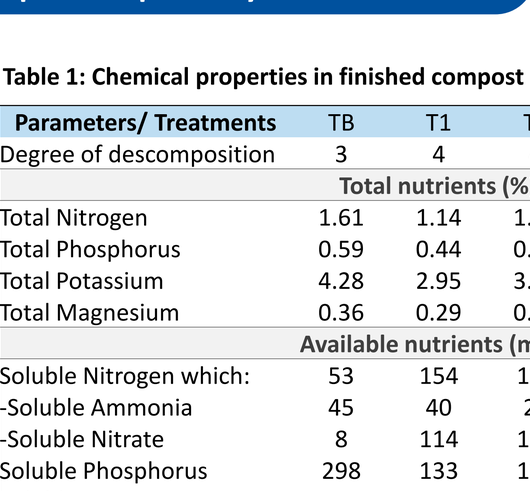
Parameters/ Treatments	TB	T1	T2	T3	T4	T5
Degree of descomposition	3	4	4	5	5	5
Total nutrients (%)						
Total Nitrogen	1.61	1.14	1.37	1.06	1.36	1.31
Total Phosphorus	0.59	0.44	0.46	0.46	0.44	0.47
Total Potassium	4.28	2.95	3.19	2.87	2.96	2.93
Total Magnesium	0.36	0.29	0.35	0.36	0.33	0.33
Available nutrients (mg/l)						
Soluble Nitrogen which:	53	154	126	150	342	270
-Soluble Ammonia	45	40	23	22	66	108
-Soluble Nitrate	8	114	103	128	276	162
Soluble Phosphorus	298	133	122	150	65	51
Soluble Potassium	10700	10900	9750	11400	9920	10400
Soluble Magnesium	19	27	30	44	48	43
Plant tolerance (%)						
25% test substrate content	75	97	103	95	100	102
50% test substrate content	52	82	87	90	88	95

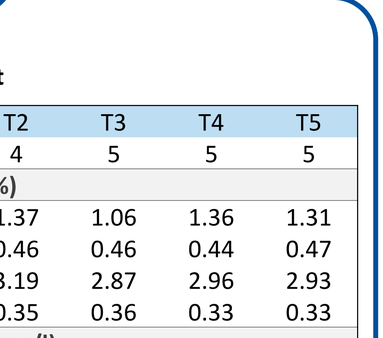
Treatments:

TB: Control(100% pulp)
T1: 80% pulp-20% GW
T2: 75% pulp-25%GW
T3: 70% pulp-30% GW
T4:60% pulp- 30% GW
T5: 50% pulp-50% GW

GW: Green waste

TB: Current treatment of the Mill

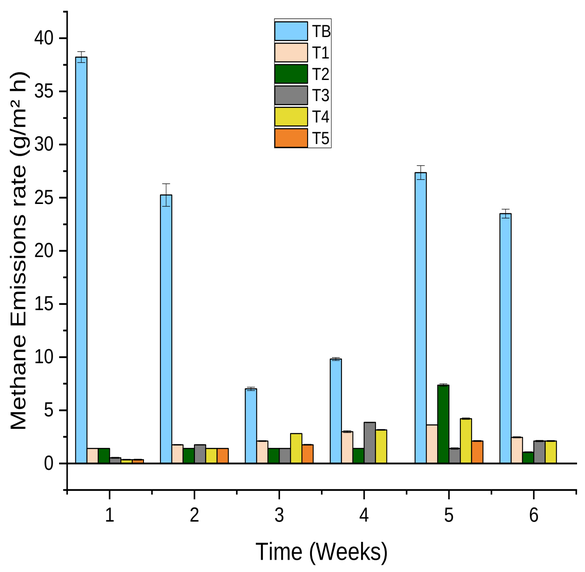




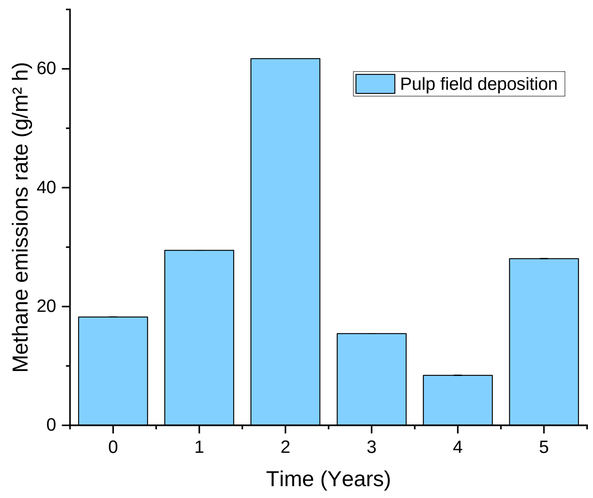
6 weeks of composting

Finished compost

Results: Methane emissions



- Pulp mixed with GW: reduccion in emissions
- Poor aeration and high moisture enhance the methane formation (TB).
- The addition of GW increases the volume of pore. and therefore improves the exchange of water and air (T1-T5).



- Over time, the pulp is not degraded, producing continuous emissions of great magnitude when is not proper treated

Highlights and future steps

- Waste valorization within the process
- Coffee pulp is suitable for composting if green waste is added
- Reduction of methane emissions, larvae and odors is achieved
- Quality compost within the threshold for some values of BKG with the addition of green waste is achieved

Future steps:

- ➢ Emission factor for the coffee sector with the improved treatment
- ➢ Personnel Mill Training
- ➢ Compost field trials in the coffee plantations