



A Novel Method to Accelerate the Degradation Rate of Plant-based Tableware Using Compost Tea

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Abstract



Compost tea is a leachate of food scraps and soil that can be brewed in under 48 hours, producing bacteria rich material significantly faster than traditional compost. It is proven to more rapidly and efficiently increase nutrient and microbial concentration in the soil, while also promoting plant growth, health, and disease resistance. This study, however, focused on the tea's effect on the degradation of plant based materials. It was hypothesized that aerated compost tea will increase the degradation rates of plant based tableware while also increasing nutrient content in the soil used. After the experiment was completed, it was confirmed that the hypothesis was true, and that aerated compost tea can help entire sugarcane bagasse bowls degrade completely in 30 days.

Background



- Composting is the process of decomposing organic matter to create a natural fertilizer
- Aerated Compost Tea (ACT) is a solution, ready in 24-36 hours, that contains thousands of active bacteria, protozoa, and fungi
- ACT can be produced with different ratios of molasses and humic acid to feed different microorganisms
- Little research has been done on compost tea in general, most of it focuses on the growth and disease resistance of plants
- Compost tea has been shown to lower disease ratings in plants

**Research Question: Does Aerated Compost Tea
Affect the Degradation of Plant-based Tableware
and the Nutrient Concentration of the Soil Used?**

Hypothesis: Degradation rates of plant-based tableware will increase and nutrient concentration in the soil will also increase due to increased microbial density and NPK values of soil.

Materials

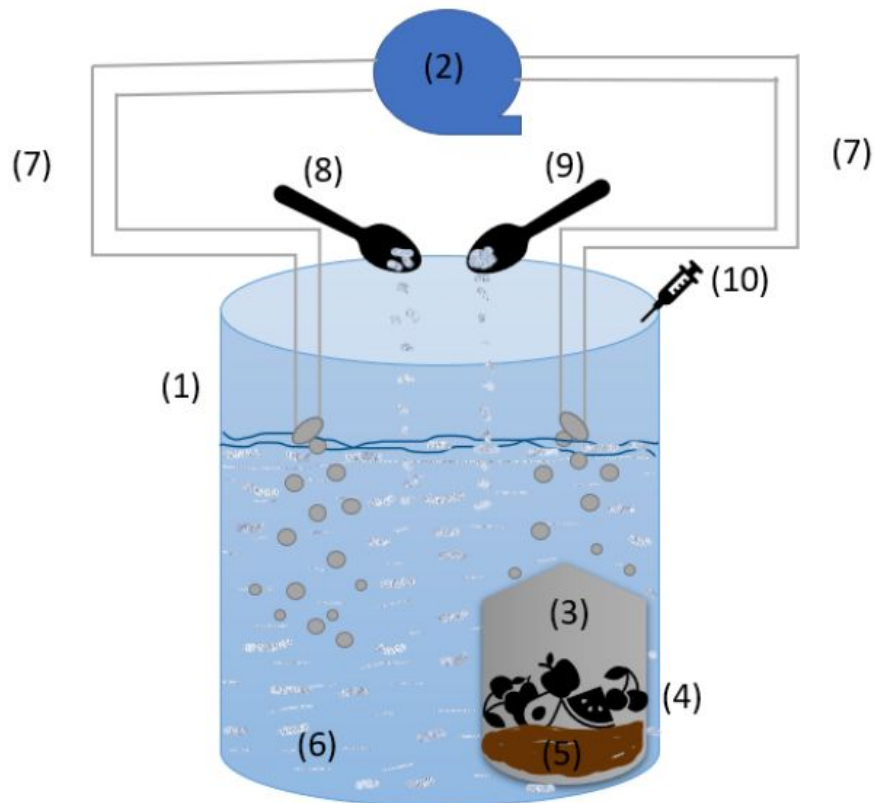


- Sugarcane Bagasse Bowls
- 5 Gallon Bucket + Lid
- Polyethylene Pipes
- Braided PVC Hose
- Brass Hose Nozzle
- 50 Watt Aquarium Aerator
- Molasses
- Humic Acid
- Chlorine Removal Solution
- Food Scraps
- Compost
- Paint Strainer Bags
- Soil Humidity Meter
- Handheld Shovel
- NPK Test Kits

Methods



- Experiment aimed to build compost tea brewer and investigate its impact on plant-based tableware and soil nutrients
- Compost tea brewer made by fitting 4 pipes into 5-gallon bucket lid, adding brass nozzles and PVC hoses, and connecting to aerator
- Brewing process involved adding water, chlorine removal drops, molasses, humic acid, compost, and food scraps and brewing for 24 hours
- Tea distributed to 9 test samples and 3 control plates kept separately in soil
- Soil moisture and pH measured daily during trial period
- New batch of tea made and distributed to samples every 10 days
- Soil nutrient test administered at end of each 10-day interval.



- (1) - Five Gallons bucket with lid perforated for tubes
- (2) - 50 Watts Aerator machine
- (3) - Net Bag
- (4) - Food scraps (190 grams)
- (5) - Compost (190 grams)
- (6) - 4 Gallons of water
- (7) - Cross-linked polyethylene tubes
- (8) - 2 tablespoons of Molasses
- (9) - 2 tablespoons of Humic acid
- (10) - 5 drops of Chlorine removal solution

Figure A: Aerated Compost Tea Brewing System (ACTBS)

Results



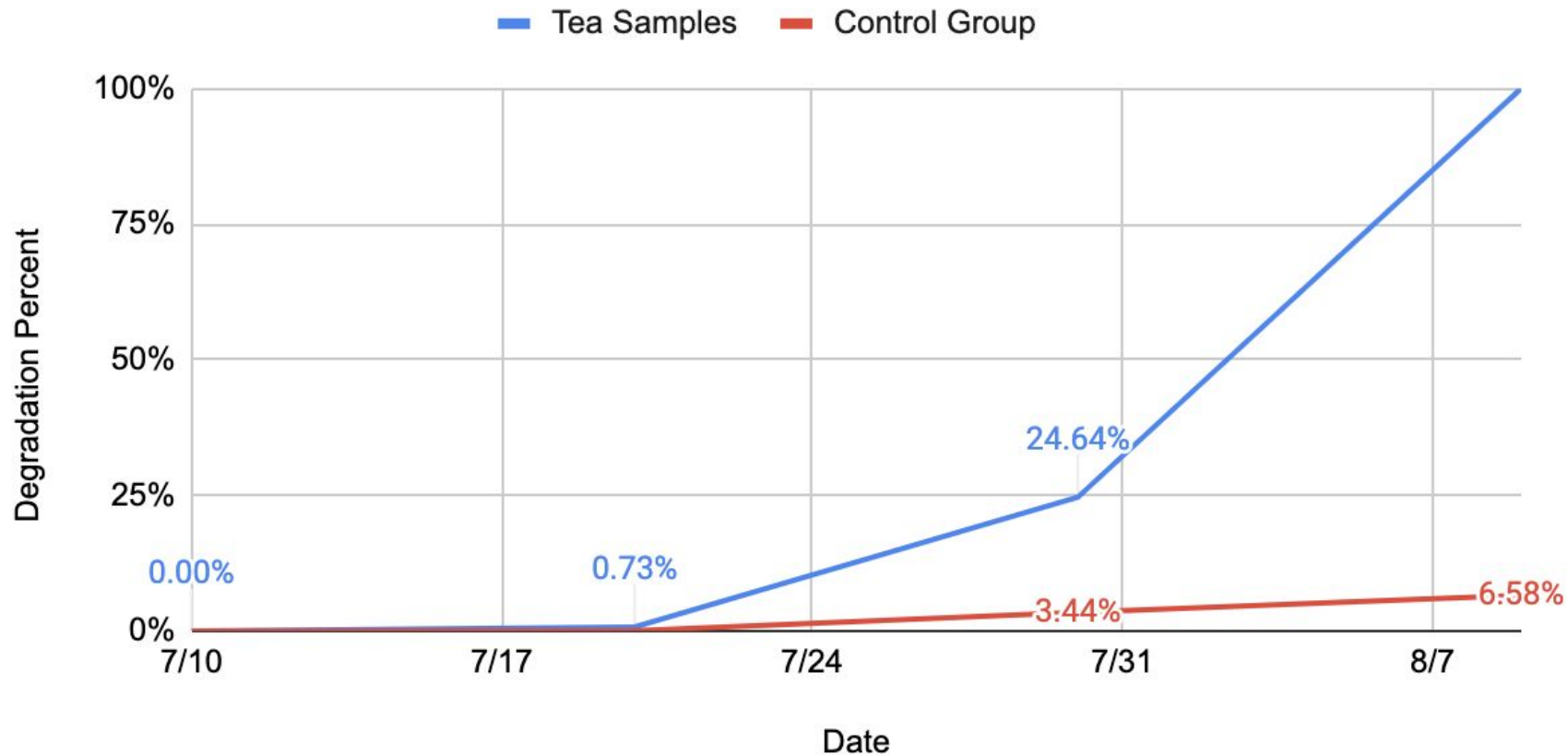
- Samples removed every 10 days to calculate degradation progress
- Photographs taken, outlines placed on grid, and percent degraded calculated
- Sugarcane bowl tea samples had 0% degradation on day 0, 0.73% on day 10, 24.64% on day 20, and 100% on day 30
- Control group had 0% degradation on day 0, 0.02% on day 10, 3.44% on day 20, and 6.58% on day 30
- Soil moisture and pH levels recorded daily during 30-day trial period to identify any patterns with degradation percentage.

Results

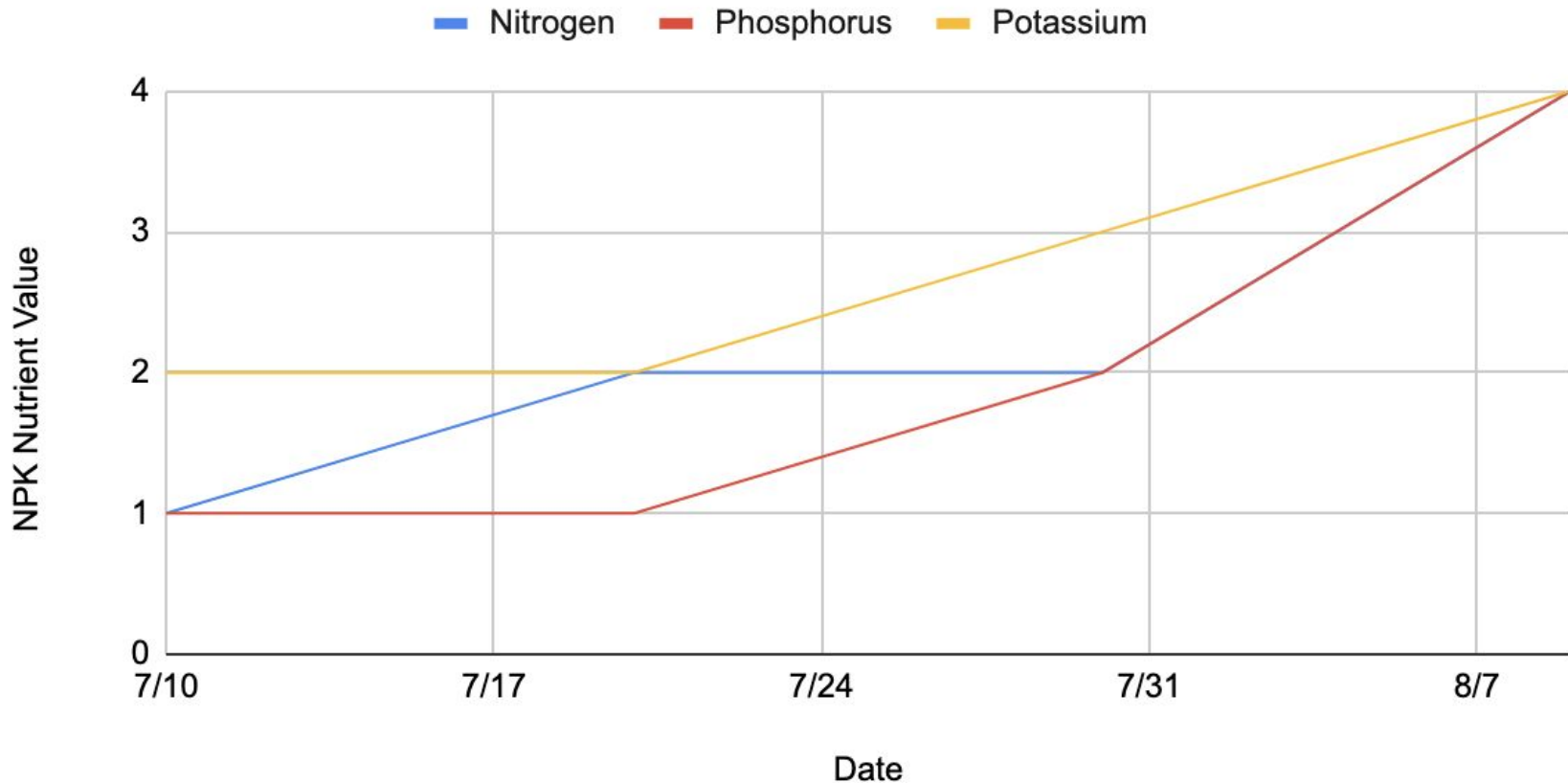


- Soil samples taken every 10 days for nutrient testing using NPK kits
- On day 0, nitrogen and phosphorus levels were deficient and potassium had traces
- On day 10, nitrogen increased to level 2, phosphorus remained at level 1, and potassium remained at level 2
- On day 20, nitrogen remained at level 2, phosphorus increased to level 2, and potassium increased to level 3
- On day 30, nitrogen, phosphorus, and potassium levels were all at level 4 (surplus)

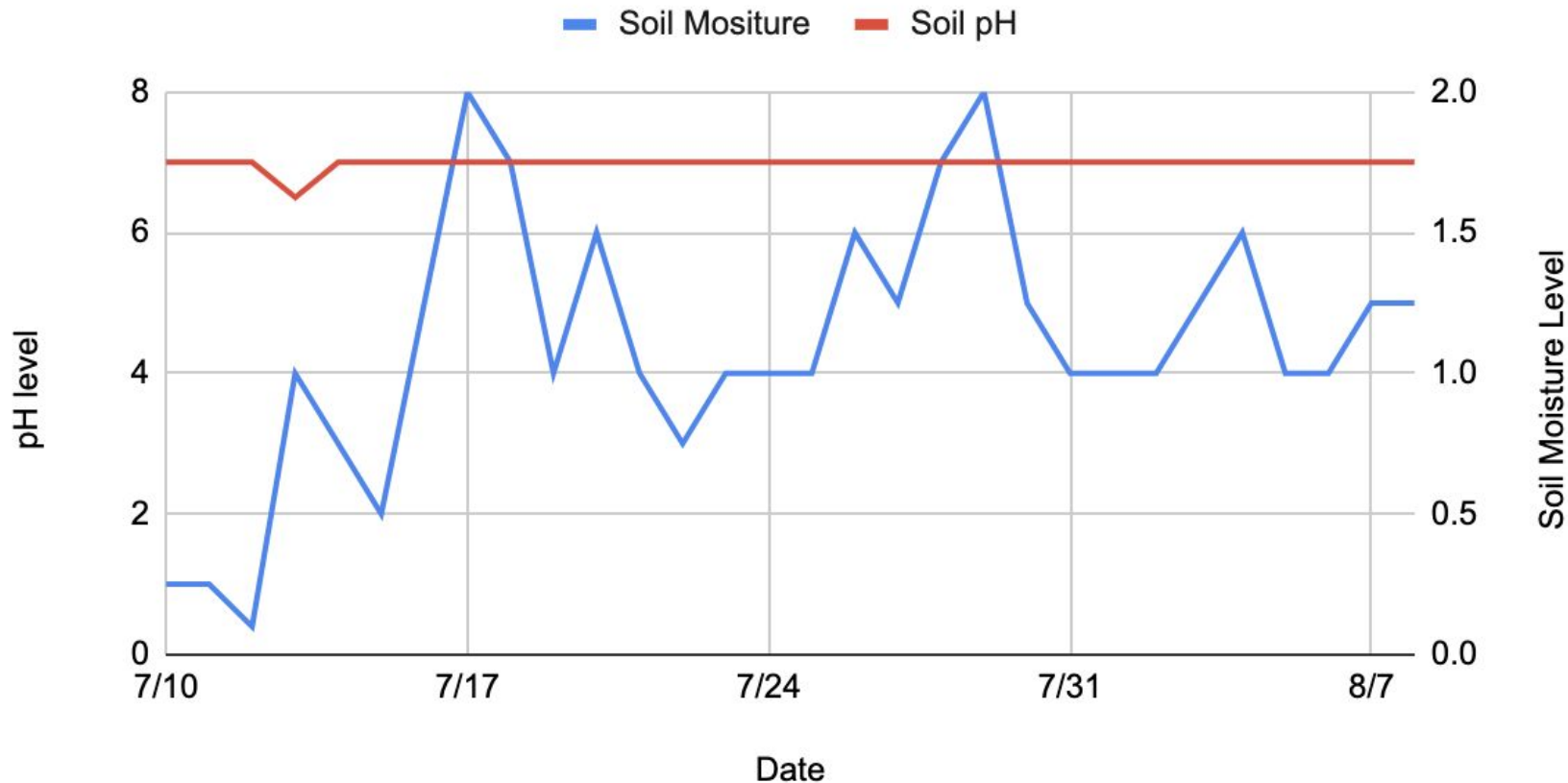
Average Percent Degradation of Sugarcane Bowls During 30 Day Trial Period



Nitrogen, Phosphorus, and Potassium Levels of Soil Over 30 Day Trial Period



Soil Moisture and pH Levels of Soil Throughout the 30 Day Trial Period



Discussion and Conclusions



- Soil erosion is caused by natural factors and worsened by climate change, leading to topsoil degradation.
- Compost tea is a promising solution to improve soil quality and increase nutrient content in a short period of time.
- The experiment found that compost tea increases the degradation rate of sugarcane bagasse tableware and improves soil nutrient content.
- Compost tea also kept soil pH neutral and increased soil moisture levels.
- Biodegradable products could pose a challenge in landfills, but compost tea could help speed up degradation in that scenario.
- Overall, compost tea is a viable solution to improve soil quality and increase degradation rates of biodegradable products.

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