USING COMPOST TO REDUCE CARDBOARD WASTE AND EXPLORING THE RELATIONSHIPS MICROBES PLAY

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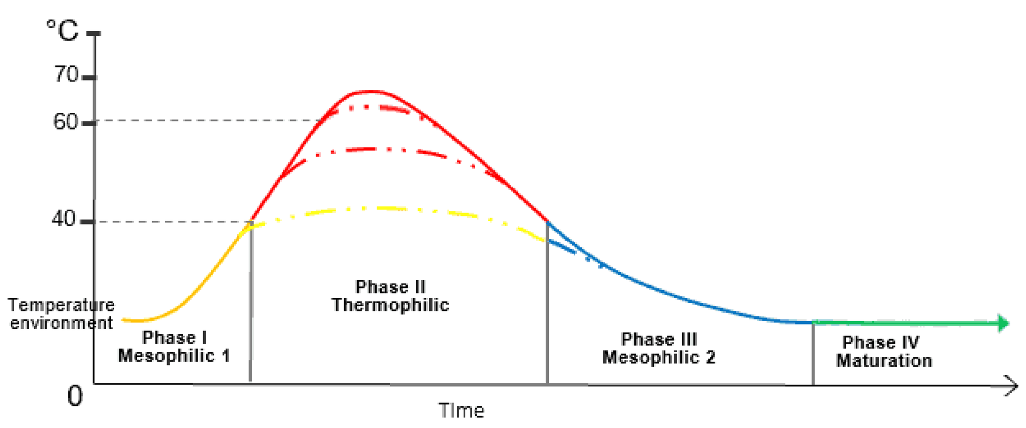
INTRODUCTION

IMPORTANCE OF COMPOSTING

- Reduces food waste and cardboard in landfills
- Creates viable fertilizer for agricultural purposes
- Reduces greenhouse gas emissions like methane
- Recyling is water and energy intensive (324L of water to make 1kg of paper)

TEMPERATURE PHASES



INCREASED MICROBIAL DIVERSITY

- Millions of microbes like bacteria and fungi live in compost
- Microbes breakdown organic matter and turn the waste into usable fertilizer
- Increased microbial diversity improves nutrient cycling and water retention
- Microbes share a symbiotic relationship with plants that aid in plant growth, yield, nutrient uptake and nutrient cycling

TYPES OF CARDBOARD

- Two main types
  - corrugated: has an additional wavy fibre, are items like shipping or packing boxes
  - paperboard/clipboard: short recycled fibres, are items like cereal boxes and pop cases
- Are the two most common types of cardboard in households
- Cardboard contains inks, dyes, and other elements that give it a glossy finish
- Heavy metals like zinc, iron, lead, copper, cadmium, chromium and barium are added to cardboard
- Testing if these toxins will impact the microbial community

METHODOLOGY

Carbon:Nitrogen

Ratio of starter
↓
Ration after addition of cardboard
↓
Blance by adding food waste
↓
35:1
↓
Place samples in compost bins

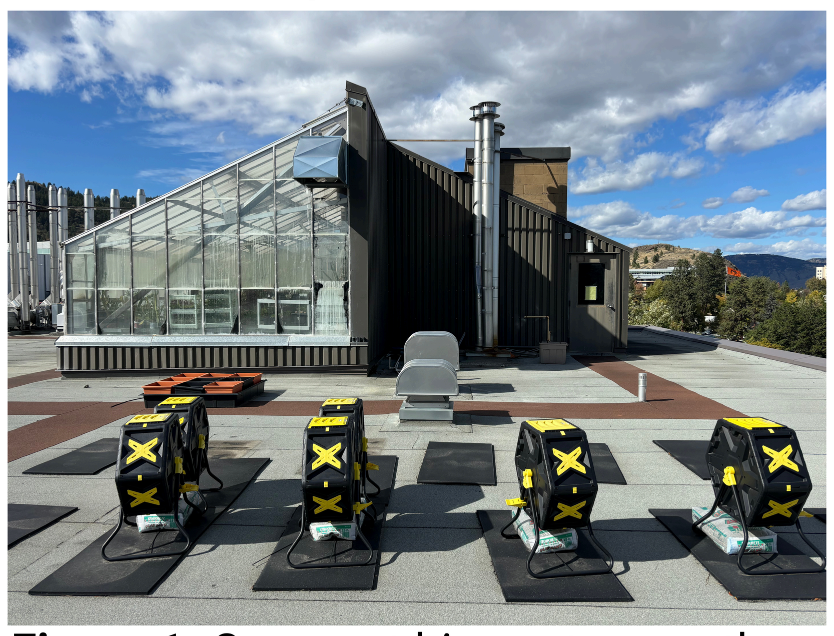
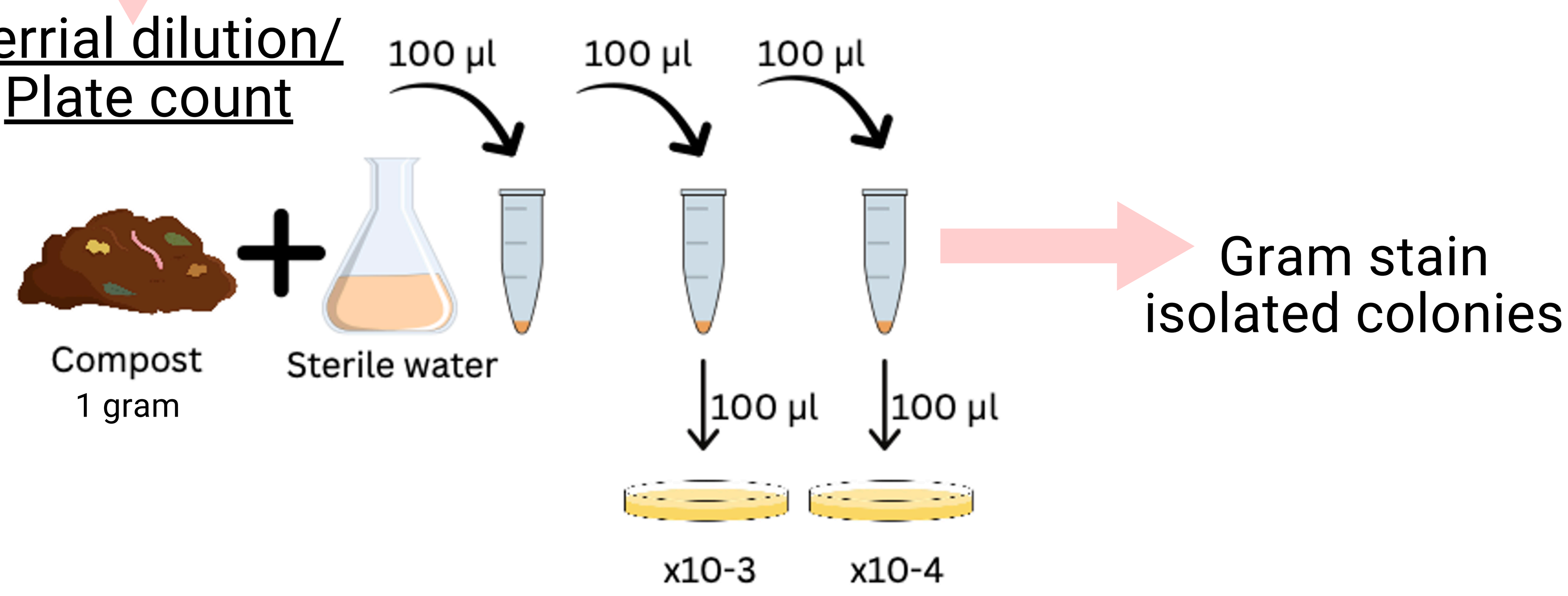


Figure 1. Compost bins set up on the roof of TRU science building.

↓

Serrial dilution/ Plate count



Calculations for Carbon-Nitrogen Ratio

Compost Starter (0.44 lbs total)
- 0.22 lbs of wood chips
- 0.22 lbs of Municipal city food waste

Wood chips:
(0.22 lbs wood chips) x (40% C) = 0.088 lbs C
(0.22 lbs wood chips) x (0.1% N) = 0.00022 lbs N

Municipal city food waste:
(0.22 lbs municipal city food waste) x (10% C) = 0.022 lbs C
(0.22 lbs municipal city food waste) x (1.0% N) = 0.0022 lbs N

Cardboard (0.133 lbs)
(0.133 lbs cardboard) x (40% C) = 0.0532 lbs C
(0.133 lbs cardboard) x (0.1% N) = 0.000133 lbs N

Food waste (0.2866 lbs)
(0.2866 lbs food waste) x (10% C) = 0.02866 lbs C
(0.2866 lbs food waste) x (1.0% N) = 0.002866 lbs N

Total carbon value
0.088(wood chips) + 0.0022(municipal city food waste) + 0.0532(cardboard) + 0.002866(food waste) = **0.19186** lbs of carbon

Total nitrogen Value
0.00022(wood chips) + 0.022(municipal city food waste) + 0.000133(cardboard) + 0.02866(food waste) = **0.0054.9** lbs of nitrogen

Carbon-Nitrogen ratio
0.19186 lbs of carbon / 0.005419 lbs of nitrogen = 35
= **35:1** C:N ratio

RESULTS

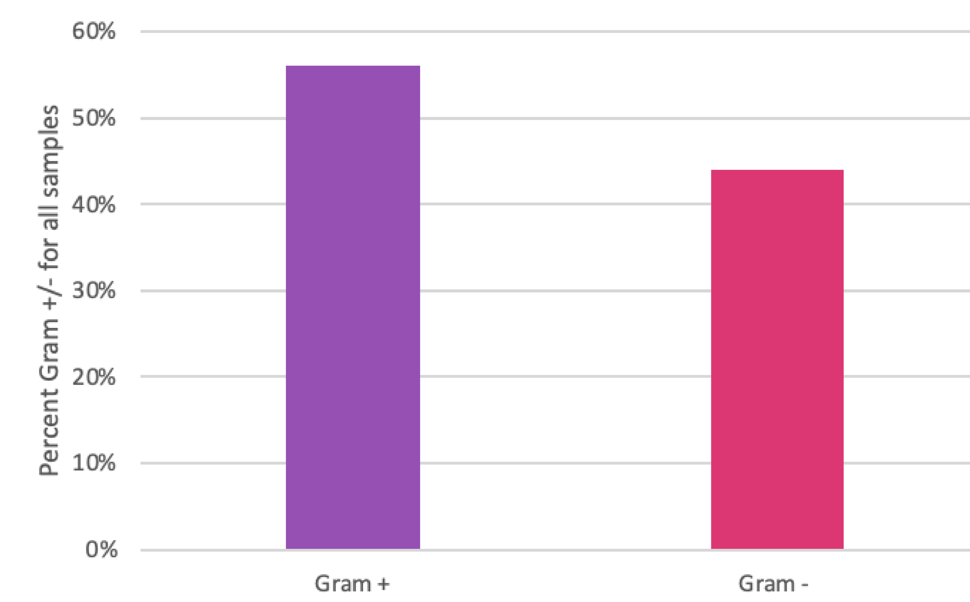


Figure 2. Combination of Gram-positive and Gram-negative bacteria in all initial (after two weeks of maturation) compost trials.

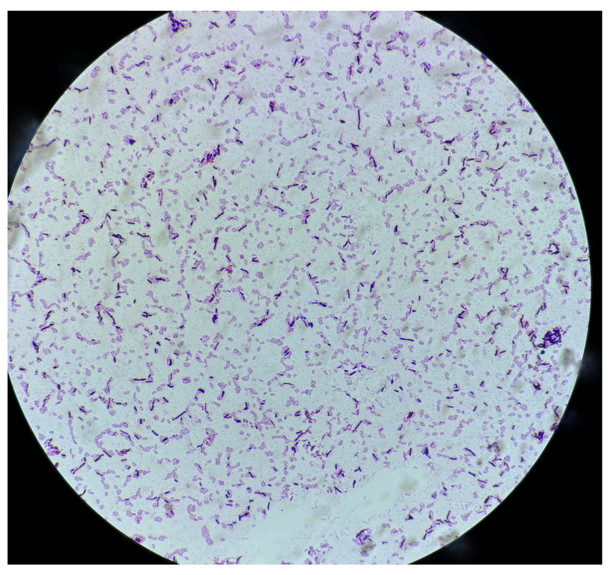


Figure 3. Gram-positive rod-shaped bacteria from control x10 dilution plate.

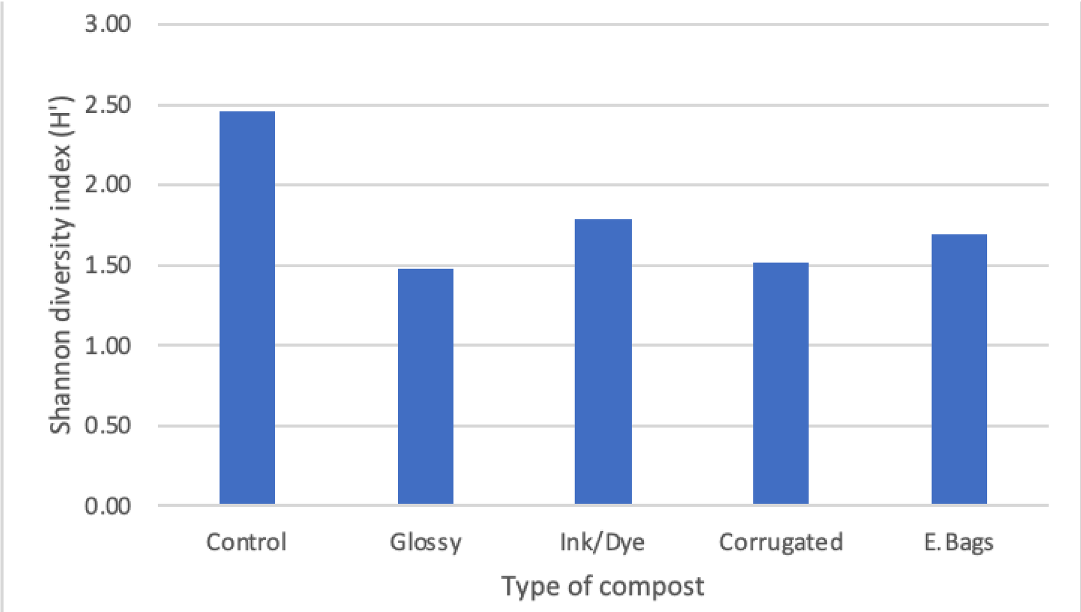


Figure 4. Shannon diversity index shows the diversity for all five compost trials.

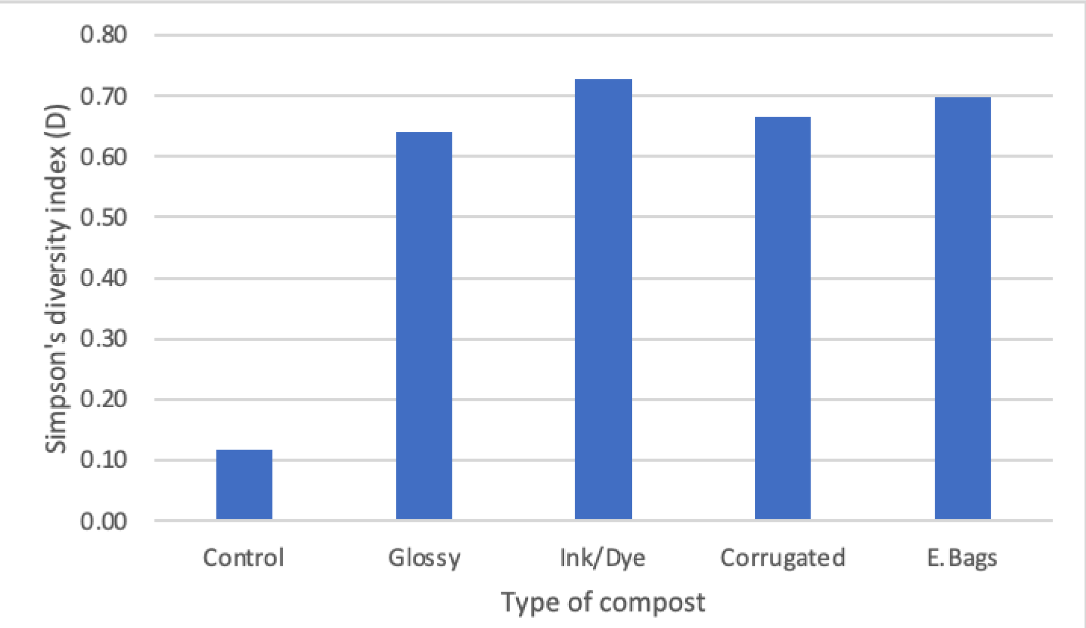


Figure 5. Simpson's diversity index showing the discovery for all five compost trials.

Table 1. Site by site matrix showing the Bray Curtis Dissimilarity between all five compost trials.

	Control	Glossy	Ink/Dye	Corrugated	Back to Earth Bags
Control	X	0.54	0.59	0.60	0.65
Glossy	0.54	X	0.49	0.59	0.46
Ink/Dye	0.59	0.49	X	0.39	0.38
Corrugated	0.60	0.59	0.39	X	0.26
Back to Earth Bags	0.65	0.46	0.38	0.26	X

DISCUSSION

In conclusion, the addition of cardboard to compost does increase the microbial community. Comparing the different types of cardboard gives variable results for Simpson and Shannon diversity indexes for which type of cardboard has the most diverse microbial community. However, the Bray Curtis dissimilarly shows that all experimental cardboard trial are similar to one another. These similar values can explain the discrepancies in the H' and D values.

References