Chapter 1. Introduction

1.1 Background

The global human population spike is considered a world issue that consequently provides several repercussions towards other global crises, such as energy conservation, world hunger and ecological degradation. By 2050, the human population will approximately reach 9.7 billion people (Ehrlich and Harte, 2015); therefore, it is essential to improve productivity and sustainability within agricultural sectors in order to meet the nutritional requirements of humanity.

Current agricultural practices still regularly use synthetic fertilizer, However, overuse of synthetic fertilizers to grow crops is threatening agricultural sustainability itself. The lack of biodegradability of agrochemicals is able to negatively affect soil parameters such as structure, fertility and water holding capacity. The long-term use of chemical fertilizers could cause the decline of soil nutrient content, causing crops to be more susceptible to a variety of diseases (Mącik et al., 2020). Microbial exploitation in the form of biofertilizers could provide an alternative option to chemical fertilizers for agricultural purposes, attributed to their potential in improving food safety and crop production(Mahanty et al, 2017)

Biofertilizers are bio-inoculants containing live microorganisms that provide beneficial properties toward the growth and development of surrounding plants(Mącik et al., 2020). Due to the specificity in the mechanism of the microorganism plant interaction within biofertilizers during soil fertilization, it is of utmost importance to understand the characteristics of these PGPMs to obtain maximum efficiency and effectiveness in the use of these Biofertilizsers.

Potential plant growth-promoting microorganisms (PGPM) are microbes that are essential in enhancing plant growth and development through secretion of various metabolites and hormones, through nitrogen fixation, and by increasing other nutrients' bioavailability through mineral solubilization (Ajijah et. al, 2023; Poria et. al., 2022). PGPM isolation and evaluation are essential steps in determining the microbial capability in improving plant development and productivity. (Ambrosini et al, 2017).

For this study, the Takakura Composting Method (TCM) was selected as the composting method to identify the PGPMs. The Takakura Composting Method utilises a fermenting bed in which fermentative microorganisms are cultivated. Local fermented foods, such as Rice bran, soy sauce, yoghurt, and rice husks are possible options to be used as the fermentative bed (Nuzir, 2019).

Biolog EcoPlate™is a community analysis microplate that consists of triplicate of water and 31 different carbon sources. (Sofo and Ricciuti, 2019) A tetrazolium redox dye is employed as an indicator of microbial samples extracted from endophyte and rhizosphere into the EcoPlate , in which the carbon source utilisation patterns (CSUPs) generated by the microorganism will define its physiological characteristics.

1.2 Objective

The objective of this study is to determine the presence of potential plant growth-promoting microbes (PGPM) from bacterial communities of Takakura compost-treated and untreated soil within the Endosphere and the Rhizosphere Saga plant (*Abrus precatorius* L) and compare the microbial activity and diversity between treated and non-treated samples.

1.3 Hypothesis

The presence of PGPMs within treated and untreated samples, with Takakura compost treated samples of Rhizosphere and Endosphere having increased microbial activity and increased diversity of carbon utilisation in comparison to untreated samples.