UNIVERSITI PUTRA MALAYSIA

THE PERFORMANCE OF PHOSPHATE SOLUBILIZING BACTERIA (PSB) ON GROWTH, PHENOLIC, AND FLAVONOID CONTENT OF Orthosiphon stamineus (MISAI KUCING) IN THE PRESENCE OF DIFFERENT RATES OF ORGANIC FERTILIZER

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BY

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A project report submitted to Faculty of Agriculture, Universiti Putra Malaysia, in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science

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CERTIFICATION

This project entitled "The Performance of Phosphate Solubilizing Bacteria (PSB) on Growth, Phenolic, and Flavonoid Content of *Orthosiphon stamineus* (Misai Kucing) in The Presence of Different Rates of Organic Fertilizer" is prepared by Nur Farahain binti Mesenan and submitted to the Faculty of Agriculture in fulfillment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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ABSTRACT

Orthosiphon stamineus is the herbal plant that is listed as a high-value product for commercialization, especially in terms of its health benefits. In herbs cultivation, meet the fertilizer application is important at the early stages of planting to achieve its maximum growth. However, now we are facing a serious problem on the lack of P element availability in soils which can cause stunted growth to the plant. In order to overcome this problem, application of organic fertilizer is highly recommended because it can supply nutrients needed by plants. Besides, the uses of phosphate solubilizing bacteria (PSB) that acts as a biofertilizer together with organic fertilizer will help to exchange insoluble phosphorus to the available form for plant uptake. The objective of this study is to determine the effect of phosphate solubilizing bacteria (PSB), the different rates of organic fertilizer and the combination of PSB and organic fertilizer on the growth of *O. stamineus*. In this experiment, there are six treatments were applied which is control, single used of phosphate solubilizing bacteria (PSB), 56.88g of organic fertilizer, 28.44g of organic fertilizer, the combination of 56.88g of organic fertilizer and PSB, and the combination of 28.44g of organic fertilizer and PSB with five replications for each treatment. These 30 experimental units were arranged in a Complete Randomized Design (CRD) experiment at the Agrobiotechnology Laboratory, Faculty of Agriculture, UPM. Data collection was taken once every 2 weeks after fertilizer application and bacteria inoculation for parameters plant height (cm), number of branches, and chlorophyll content (SPAD unit) and next, the data that was collected at 11^{th} week are fresh and dry weight of roots, leaves, and stems (g), length of roots (cm), total phenolic content (mg GA/ g dry weight) and total flavonoid content (mg RU/ g dry weight). The result obtained show that both of the combined application had a significant effect on all of the parameters except, chlorophyll content parameter.

ABSTRAK

Orthsosiphon stamineus adalah tumbuhan herba yang disenaraikan sebagai produk bernilai tinggi untuk dikomersialkan, terutama sekali dari segi kelebihannya dalam kesihatan. Dalam penanaman herba, memenuhi keperluan baja adalah penting pada peringkat awal penanaman untuk mencapai pertumbuhan yang maksimum. Walaubagaimanapun, kini kita sedang menghadapi masalah yang serius terhadap kekurangan ketersediaan unsur P dalam tanah yang boleh menyebabkan pertumbuhan tumbuhan terbantut. Bagi mengatasi masalah ini, penggunaan baja organik amat disyorkan kerana ia boleh membekalkan nutrient yang diperlukan oleh tumbuhan. Selain daripada itu, penggunaan bakteria pelarut fosfat (PSB) yang bertindak sebagai biobaja bersama-sama dengan baja organik akan membantu untuk menukarkan fosforus yang tidak larut pada bentuk yang boleh diambil oleh tumbuhan. Kajian ini dijalankan bertujuan untuk menentukan keberkesanan bakteria pelarut fosfat (PSB), kadar baja organik yang berbeza serta gabungan penggunaan bakteria pelarut fosfat (PSB) ke atas pertumbuhan *O. stamineus*. Dalam kajian ini, enam rawatan telah digunakan iaitu kawalan, bakteria pelarut fosfat secara tunggal, 56.88g baja organik, 28.44g baja organik, gabungan 56.88g baja organik dan PSB, dan gabungan 28.44g baja organik dan PSB dengan lima replikasi bagi setiap rawatan. 30 unit ujikaji ini telah diatur menggunakan Rekabentuk Rawak Lengkap (CRD) di Makmal Agrobioteknologi, Fakulti Pertanian UPM. Pengumpulan data telah diambil sekali setiap 2 minggu selepas aplikasi pembajaan dan inokulasi bakteria bagi parameter ketinggian tumbuhan (cm), bilangan dahan, dan kandungan klorofil (unit SPAD) dan seterusnya, data yang dikumpulkan pada minggu ke-11 ialah berat basah dan kering akar, daun, dan batang (g), panjang akar (cm), jumlah kandungan fenolik (mg GA/g berat kering) serta jumlah kandungan flavonoid (mg RU/g berat kering). Keputusan yang diperolehi menunjukkan

penggunaan aplikasi gabungan mempunyai kesan yang ketara ke atas semua parameter kecuali, parameter kandungan klorofil.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Malaysia is a country that rich with natural and traditional plants which made Malaysia as one of the major producers in herb industry. Due to the latest developments in the world herbs production, Malaysia has created a variety of initiatives to improve the income of this industry as the demand for herbs is high and favourable in line with the developments of industries which require herbs as the main source of raw material in the production of their product. Referring to the development of the National Key Economy Area (NKEA), *Orthosiphon stamineus* or Misai Kucing herb is one of the main herbs that is listed for commercialization in Entry Point Project (EPP1) with the objective to produce high value products in order to achieve the gross national income of RM2.2 billion (MOA, 2015).

This herb is a plant that belongs to a family Lamiaceae. It is a herbaceous shrub plant that have rapid growth around 10 weeks to 12 weeks. Other than that, this plant is classified in accordance with the unique morphology of its flowers which resembles cat's whiskers. However, two types of variety that are available in Malaysia has identified through its flower colour where the white flowers are known as MOS 1 variety and the purple flowers known as MOS 2 variety where both of it have differences in terms of its growth (Himani *et al*., 2013).

Nevertheless, *O. stamineus* is a sensitive crop which requires a sufficient amount of water in the early stages of cultivation to ensure the healthy growth of plants. With this, it can reduce heat stress on crops. Apart from that, in order to achieve the maximum plant growth, hence, meet the needs of fertilization is important in the cultivation of herb plants. So that is why, in the early stages of cultivation, the use of organic fertilizer is highly recommended as it composed of organic materials which can provide natural nutrients to the plants and it is environmentally friendly because of free from toxics. Furthermore, by using organic fertilizer it will reduce the reliance on chemical fertilizers which requires a very high cost and also it can improve the quality of organic matter and humus content in soils.

In the meantime, most of the land in Malaysia has a lack of nutrient problems. Due to this problem, it can also result where there is only a small amount of available nutrients that can be taken up by plants such as the unavailable form of phosphorus (P) element for plant uptake. Thus, the use of Phosphate solubilizing bacteria (PSB) together with organic fertilizer will help in exchange of insoluble phosphorus in the soil to the available form because of it contains good living microbes in it. Other than nitrogen (N) element, phosphorus (P) element is also plays an important role in the early stages of cultivation, such as stimulating root growth, flower production and improve the endurance system of the plants and thus produce a good impact on plant growth. Ergo, at the end of this study we will evaluate the effect of using only phosphate solubilizing bacteria (PSB) and organic fertilizer or combinations of them on the growth of *O. stamineus.* Slightly by conduct this experiment, it helps to determine the best suitable rate of organic fertilizer that needs by the plant since in Malaysia we have insufficient data about it.

OBJECTIVE

To identify the effect of Phosphate solubilizing bacteria (PSB), the different rates of organic fertilizer and the combination both of it on the growth, phenolic, and flavonoid content of *O. stamineus*.

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