UNIVERSITI PUTRA MALAYSIA

THE EFFECT OF N2- FIXING BACTERIA AND SPLIT TIME APPLICATION ON GROWTH OF Oryza sativa

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By

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DEPARTMENT OF AGRICULTURE TECHNOLOGY
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CERTIFICATION FORM

This project paper entitled "The effect of N_2-fixing bacteria on rice plant and split time application on *Oryza Sativa*" is prepared by Tuan Syaripah Najihah Tuan Bt Mohd Razali and submitted to the Faculty of Agriculture in the fulfilment of the requirement of PRT4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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ABSTRACT

Rice plant or its scientific name, *Oryza sativa* is the staple food of Malaysia. Rice (*Oryza sativa* L.) is one of the most important food crops in the world and more than 90% of rice is produced and consumed in Asia. In order to increase the production of this crop, various methods have been done including the use of plant growth-promoting rhizobacteria (PGPR). Plant growth- promoting rhizobacteria (PGPR) are defined as root-colonizing bacteria that exert beneficial effects on plant growth and development. Nitrogen fertilizer is also used widely in rice plant production. But, only little nitrogen is absorbed by the plant and the rest is loss. The efficiency of the urea-N in rice culture is very low, generally around 30–40%, in some cases even lower. It is such a waste of input for not applying this fertilizer and bacteria at the correct time. Therefore this experiment is conducted to observe the effect of N_2-fixing bacteria on rice plant and split time application on rice plant and to determine if there is any interaction between nitrogen fertilizer and split time application of N_2-fixing bacteria on the growth of rice plant. Five treatments including one control with 6 replications were used in this experiment and are arranged by using RCBD. The nitrogen fertilizer was applied at the beginning of experiment while the N_2-nitrogen fixing bacteria (UPMB10) was applied on 15^{th}, 30^{th}, 45^{th}, 60^{th} day after planting. The results showed that *Bacillus sphaericus* (UPMB10) increase the rice plant's dry weight by 10.81%, root volume by 23.18%, root length by 9.93%, root surface area by 13.7% and nitrogen content by 4.36%. The most effective time to inoculate this bacteria is on the 45^{th} day after planting. An early inoculation time did not give any advantage to the growth response of *O. Sativa*.

ABSTRAK

Padi atau nama saintifiknya, *Oryza sativa* merupakan makanan ruji rakyat Malaysia. Padi (*Oryza sativa* L.*)* adalah salah satu tanaman makanan yang paling penting di dunia dan lebih daripada 90% daripada beras yang dihasilkan dan digunakan di Asia. Dalam usaha untuk meningkatkan pengeluaran tanaman ini, pelbagai kaedah telah dilakukan termasuk penggunaan rhizobakteria penggalak pertumbuhan tanaman (PGPR). Penggalak (PGPR) merupakan bakteria yang memberi kesan baik terhadap pertumbuhan dan pembangunan tumbuhan. Baja nitrogen juga digunakan secara meluas dalam pengeluaran tanaman padi. Tetapi, hanya sedikit nitrogen diserap oleh tumbuhan dan selebihnya hilang. Keberkesanan baja urea dalam penanaman padi adalah sangat rendah, umumnya sekitar 30-40%. Ini merupakan satu pembaziran input jika baja dan bakteria ini tidak digunakan dalam masa yang betul. Eksperimen ini dijalankan untuk melihat kesan bakteria pengikat nitrogen terhadap tanaman padi dan pengaplikasian waktu yang berbeza dan interaksi antara baja nitrogen dan bakteria pengikat nitrogen terhadap pertumbuhan padi. Lima rawatan termasuk satu kawalan dengan 6 replikasi digunakan dalam eksperimen ini dan disusun dengan menggunakan RCBD. Baja nitrogen digunakan pada awal eksperimen manakala bakteria pengikat nitrogen (UPMB10) akan digunakan pada 15, 30, 45, 60 hari selepas menanam. Keputusan menunjukkan bahawa *Bacillus sphaericus* (UPMB10) meningkatkan berat kering daun padi sebanyak 10.81%, isipadu akar sebanyak 23.18%, panjang akar sebanyak 9.93%, luas permukaan akar sebanyak 13.7% dan kandungan nitrogen sebanyak 4.36%. Masa yang paling efektif untuk menyuntik bakteria ini adalah pada hari ke 45 selepas menanam. Penginokulatan pada peringkat awal tumbesaran tidak memberi kelebihan kepada tumbesaran *O. Sativa*.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Oryza Sativa or its commonly known as rice plant is a staple food for many countries including Malaysia. It is one of the world's most important crops that is widely planted in Asia. Rice plant can be planted in the lowland or highland using terraces. In Malaysia, it is commonly planted in lowland because it produces a higher yield compared to highland rice. According to DOA (2011), paddy cultivation area in 2011 for Malaysia is 683,677 hectare, but Malaysia is still importing 960,000 metric tonnes of rice from the neighbouring countries to meet the total needs for our nation's rice. It shows that Malaysia self-sufficiency for rice is still not enough. Therefore, it is very important to increase our rice production by increasing the technology, research and development.

Of all the farming practices, rational fertilization and management of soil fertility is one of the most important measures to improve yield and quality of rice toward a sustainable production (Lee *et al*., 2008). One of the ways to improve the rice production is by using bio fertilizer. To maintain high yield of oil production, continual input of chemical fertilizer has been practiced in many paddy field. Alternatively, plant growth-promoting rhizobacteria (PGPR) can be applied to the rice plant to reduce environmental problems caused by the use of chemical fertilizers.

Biofertilizer has been identified as an alternative to chemical fertilizer to increase soil fertility and crop production in sustainable farming (Wu *et al*., 2004). It is also called beneficial microorganisms or is known as plant growth promoting rhizobacteria. PGPR have been applied to various crops to enhance growth, seed emergence and crop yield, and some have been commercialized (Dey *et al*., 2004; Herman *et al*., 2008; Minorsky, 2008). The examples of PGPR are *Bacillus, Acetobacter, Pseudomonas, Klebsiella* and many more.

As we know nitrogen is the most important nutrient to the rice plant. According to Ladha and Reddy (2003), nitrogen is the major limiting nutrient for rice production. Nitrogen is required for cellular synthesis of enzymes, proteins, chlorophyll, DNA and RNA, and is therefore important in plant growth and the production of food and feed
(Matiru and Dakora, 2003). But not all nitrogen available in soil is absorbed by the root of rice plant. Most of the nitrogen is loss during flooding, leaching and so on.

Nitrogen fixing bacteria have been used for many years to improve the fertility of soils. This kind of bacteria gives a positive effect and enhances the plant growth by increasing the ability of root to absorb nitrogen. Moreover, PGPR can reduce the cost of using chemical fertilizer especially when it is applied at the right time. The beneficial effects of plant growth promoting rhizobacteria (PGPR) have been attributed to biological N2 fixation (Boddy *et al.*, 1995; Meunchang *et al.*, 2004).

This experiment was conducted to study the effect of N_2-fixing bacteria on rice plant and split time application on rice plant and if there is any interaction between nitrogen fertilizer and split time application of N_2-fixing bacteria on the growth of rice plant.

1.2 Objectives

Therefore, the objectives of the study are:

1. To study the effect of split time application of N_2-fixing bacteria on rice plant.
2. To identify the interaction between nitrogen fertilizer and split time application of N_2-fixing bacteria on the growth of rice plant.

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