UNIVERSITI PUTRA MALAYSIA

EFFECT OF PHOSPHATE SOLUBILIZING MICROORGANISMS AND PHOSPHORUS CHEMICAL FERTILIZER ON GROWTH AND PHOSPHORUS UPTAKE OF AEROBIC RICE

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By

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CERTIFICATION FORM

This project paper entitiled “Effect of Phosphate Solubilizing Microorganisms and Phosphorus Chemical Fertilizer on Growth and Phosphorus Uptake of Aerobic Rice” prepared by Nur Sakinah Binti Ilias in partial fulfillment of requirement of PRT 4999 (Final Year Project) for the award of the Degree of Bachelor of Agricultural Science.

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ABSTRACT

In Malaysia, the cultivation of rice (*Oryza sativa*) is very important as it is the staple food of our country. A glass house study was conducted to determine the effect of phosphate solubilizing microorganisms and phosphorus chemical fertilizer on growth and phosphorus uptake of aerobic rice. The experimental treatments were arranged in Randomized Complete Block Design (RCBD) with four different bacterial treatments and three different rate of phosphorus fertilizer with 5 replications (4 × 3 × 5). The total treatments were 12 (T1 : uninoculated control + 30 kg of P_2O_5/ha; T2 : uninoculated control + 60 kg of P_2O_5/ha; T3 : uninoculated control + 120 kg of P_2O_5/ha; T4 : PSB16 + 30 kg of P_2O_5/ha; T5 : PSB16 + 60 kg of P_2O_5/ha; T6 : PSB16 + 120 kg of P_2O_5/ha; T7 : AM + 30 kg of P_2O_5/ha; T8 : AM + 60 kg of P_2O_5/ha; T9 : AM + 120 kg of P_2O_5/ha; T10 : PSB16 + AM + 30 kg of P_2O_5/ha; T11 : PSB16 + AM + 60 kg of P_2O_5/ha; T12 : PSB16 + AM + 120 kg of P_2O_5/ha). Pot experiment was conducted in the glasshouse at Ladang 10, UPM. Bacterial inoculums were applied to each of the respective pots which contain about 10 kg of soil. Plants were harvested 55 days after planting. The results showed that there was only a significant difference between bacterial treatments and rate of phosphorus fertilizer on fresh and dry weight of root. The uninoculated bacteria treatment with 60 kg of P_2O_5 / ha showed the most significant difference among the treatments for fresh and dry weight of root. However, there was no significant effect of other parameters between the interactions of the bacterial treatments and rate of phosphorus fertilizer.

ABSTRAK

Di Malaysia, penanaman padi (*Oryza Sativa*) adalah sangat penting. Ini kerana nasi merupakan makanan ruji bagi penduduk di negara kita. Satu kajian rumah kaca telah dijalankan untuk melihat dan menentukan kesan mikroorganisma pelarut fosfat dan baja kimia fosforus kepada pertumbuhan dan pengambilan fosforus padi aerobik. Rawatan eksperimen telah disusun mengikut (RCBD) dengan empat rawatan bakteria dan tiga kadar baja fosforus yang berbeza dengan 5 replikasi (4 × 3 × 5). Jumlah rawatan adalah 12 (T1: kawalan tanpa bakteria + 30 kg P_2O_5/ha; T2 : kawalan tanpa bakteria + 60 kg P_2O_5/ha; T3 : kawalan tanpa bakteria + 120 kg P_2O_5/ha; T4 : PSB16 + 30 kg P_2O_5/ha; T5: PSB16 + 60 kg P_2O_5/ha; T6 : PSB16 + 120 kg P_2O_5/ha; T7 : AM + 30 kg P_2O_5/ha; T8 : AM + 60 kg P_2O_5/ha; T9 : AM + 120 kg P_2O_5/ha; T10 : PSB16 + AM + 30 kg P_2O_5/ha; T11 : PSB16 + AM + 60 kg P_2O_5/ha; T12 : PSB16 + AM + 120 kg P_2O_5/ha). Eksperimen ini telah dijalankan di rumah kaca di Ladang 10, UPM. Inokulum bakteria telah diletakkan pada setiap satu polybag yang mengandungi kira-kira 10 kg tanah. Pokok dituai 55 hari selepas ditanam. Hasil kajian menunjukkan bahawa kesan perbezaan bererti dapat dilihat antara rawatan bakteria dan kadar baja fosforus pada berat badan basah dan kering akar. Rawatan kawalan tanpa bakteria dengan 60 kg P_2O_5/ha menunjukkan perbezaan yang paling ketara antara rawatan untuk berat basah dan berat kering akar. Walau bagaimanapun, interaksi antara rawatan bakteria dan kadar baja fosforus menunjukkan tidak ada kesan perbezaan bererti dapat dilihat pada parameter lain.

CHAPTER 1

INTRODUCTION

Rice is considered as one of the most significant and important grains in the world. It is known to have been the staple food for more than half of the world's population, especially in Asia. Rice provides 35 - 80 % of total calorie uptake (IRRI, 1997). Aerobic rice is a type of rice that is aerobic-soil-adopted and input-responsive (Parthasaranthi *et al*., 2012). It is a water saving technology (Sasaki *et al*., 2010). Aerobic rice is grown in well-drained, non puddle and non saturated soils without ponded water (Bouman *et al*., 2007). Irrigation is applied until the soil water content in the root zone is up to field capacity (Bouman *et al*., 2005)

Fertilizer is an essential input in modern agriculture to help in realizing high crop yields. After nitrogen (N), phosphorus (P) is one of the most essential elements for plant growth (Mehrvarz *et al*., 2008). Research shows that, 5.7 billion hectares (ha) of land is estimated to contain very little available P for sustaining optimal crop production (Hisinger, 2001). One of the major sources providing P in plant is from chemical fertilizers. But many researches have been conducted to find ways to reduce the usage of chemical fertilizers due to its high cost and environmental problems (Hassan *et al*., 2012).

Microorganisms are important to make available nutrients which are insoluble in soil. Microorganisms can also reduce the use of chemical fertilizers (Cakmakci *et al*., 2006). Soil fertility can be improved by application of biological

fertilizers such as biological phosphate fertilizers. Due to different mechanisms, for example, production and secretion of organic acid, bacteria such as phosphate solubilizing bacteria (PSB) and fungi such as arbuscular mycorrhizal fungi (AMF) are usually effective on phosphate solubility (Abdol *et al*., 2011).

Hence the study has been done with the following objective:

1. To determine the effect of phosphate solubilizing microorganisms and phosphorus chemical fertilizer on growth and phosphorus uptake of aerobic rice.

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