UNIVERSITI TEKNOLOGI MARA

# EFFECTS OF ARBUSCULAR MYCORRHIZAL INOCULANTS AND PHOSPHATE FERTILIZER ON GROWTH AND NUTRIENT UPTAKE OF AEROBIC RICE (*Oryza sativa* L. *VAR* MR1A)

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# ABSTRACT

Malaysia introduced aerobic rice varieties to combat water-scarce conditions under the Tenth plan Malaysia Plan (2011-2015). However, its sustainability has been jeopardized by lower average yield production, which requires an effective and cost-effective nutrient management strategy. Recent studies focused on the significance of phosphate (P) in the interaction of plants and arbuscular mycorrhizal fungi (AMF) as biofertilizer in the rice agricultural industry's development. Therefore, a pot culture experiment was carried out to evaluate the effect of different mycorrhiza inoculants and phosphate application on the growth of aerobic rice, *Oryza sativa* L. var. MR1A. Three different treatments of mycorrhiza applied were *Glomus mosseae* (GM), commercial mycorrhiza (CM) and co-inoculation of both types. Two phosphorus application levels of 0 and 300 mg $kg^{-1}$ were added to investigate the influence of inoculations on the nutrient uptake by the plant. All the treatments were designed as completely randomized design. The results showed a significant effect of co-inoculation of *Glomus mosseae* and commercial mycorrhizal in presence of P fertilizer on plant height (135.85±9.63 cm), number of tillers (17.75±1.50 nos), P uptake by shoots (0.24±0.01%) and percentage of AM root colonization (56.56±1.29%) compared to other treatments. The results indicated that AMF had increased the efficiency of phosphate fertilizer uptake by the plant. This is due to the ability of MR1A seedlings in forming a symbiotic relationship with AM fungi inoculums (*G. mosseae*, commercial mycorrhizal and co-inoculation of *G. mosseae* and commercial mycorrhizal).

***Keywords:*** Arbuscular mycorrhizal fungi, *Glomus mosseae*, Aerobic rice, Phosphorus, *Oryza sativa* L

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# TABLE OF CONTENTS

# CHAPTER ONE
# INTRODUCTION

## 1.1 Research Background

*Oryza sativa* L. (Rice) is one of the major staple food crops since more than half the world's population consumes rice in their daily life as a source of energy (Musa, Umar, & Ismail, 2011). It riches in nutrients and contains a number of vitamins and mineral, provides up to 50% of dietary calories consumed by nearly more than 520 million people in Asia (Muthayya, Sugimoto, Montgomery, & Maberly, 2014). *Oryza sativa*, grown worldwide and *Oryza glaberrima*, grown in part of West Africa are two important species of rice that beneficial for human nutrition. As rice cultivation increased and become more effective, rice cultivation replaced other grains such (millets, sorghum, wheat), root crop and forage plants (Chandrasekaran, Annadurai, & Kavimani, 2013). Globally, rice is the second most cultivated grains after corn followed by wheat, barley, and others (Statista, 2018).

In Malaysia, there are two types of cultivated paddy systems which are wetland paddy (Peninsular Malaysia, Sabah, and Sarawak, 1 422 095 ha) and dryland (Sabah and Sarawak, 51 584 ha) (Department of Agriculture, 2016a). Most farmers prefer wetland paddy due to the average yield of about 3.3 tonnes $ha^{-1}$ and up to 10 tonnes $ha^{-1}$ at several locations with better field management (Hanafi, Hartinie, Shukor, & Mahmud, 2009). Dryland paddy is usually planted for own consumption, once a year on the hillsides and undulating land with minimum water resources. Therefore, the average yield for dryland paddy is lower than wetland paddy due to soil acidity and soil erosion which leads to low nutrient input. Rice requires an adequate amount of nutrients, Phosphorus (P), Nitrogen (N) and Potassium (K) for plant growth and yield. Sufficient amount of nutrients increases crop production and sustains soil fertility (Yousaf *et al.*, 2017). An unfavourable condition such as nutrient-poor acidic soil condition rendering dryland rice inefficient in P acquisition is responsible for serious yield reduction annually in Malaysia (Toppo, Maiti & Srivastava, 2012). Reduction of natural soil fertility together with an inaccurate application of chemical fertilizer and the high cost of inputs are major constraints to rice production. Therefore, there should be an effort to minimize the dependence on chemical fertilizer