UNIVERSITI TEKNOLOGI MARA

THE INFLUENCE OF SEED RATES ON GROWTH, BIOMASS PRODUCTION AND PANICLE DEVELOPMENT OF A NEW AEROBIC RICE VARIETY- MARDI AEROB 1

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ABSTRACT

Seed rate affects plant architecture, alters growth and developmental patterns and influences biomass production and partitioning which affect rice yield considerably. Under this production system, rice is grown in well drained, non-puddled and non-saturated soils. Aerobic rice was developed to maximize yield per unit water input under water scarce environment as well as to minimize greenhouse gases (GHG) emission which is generally high under the wetland system. The field experiment using MARDI Aerob 1 rice variety was conducted at UiTM Melaka Jasin campus from February to December2015. The quantification of source and sink relationship of this new variety was carried out using seeds grown under three different seed rates; 100 (T1), 150 (T2) and 200kg/ha (T3) arranged in a randomized complete block design (RCBD with four replications. The source and sink relationship was examined based on overall growth, dry mass production and partitioning, panicle development and physiological performance during reproductive and ripening stages. All cultural practices were based on MARDI's recommended practice with standard seed rate of 100-130kg/ha and between rows distance of 25cm. The quantitative analysis on the aboveground biomass production and partitioning during reproductive and ripening stages were carried out using weekly sequential growth analysis technique. Ten uniform tillers per replicate from each treatment were harvested at 40, 47, 54, 61, 68, 75 and 82 days after sowing and harvested biomass were separated into leaves, culms and panicle for leaf area and biomass determinations. Five panicles per replicate from each treatment were used for detailed panicle analysis. The chlorophyll SPAD readings were monitored at three different stages; panicle initiation, flowering and ripening while stomatal conductance and chlorophyll *a* fluorescence were measured at active tillering and flowering stages. Under high density population (high seed rate), number of tiller (923) and panicle (545) per m^2 were significantly higher than other treatments, leaf and grain dry mass, however, were significantly higher under low density (low seed rate) than the high population treatments. For panicle morphological attributes, total branches, number of secondary branches and their respective grain number and total grain weight were significantly higher under low population than the other two high population density treatments. The maximum panicle length (26.47cm) was also obtained under the low seed rate. Similar to panicle morphological attributes, the yield components with maximum total, primary and secondary number of filled grain and 100 grain weight were also significantly higher under the low seed rate treatment as well as maximum chlorophyll concentration. Correlation and regression studies of various source and sink parameters under various seed rates generally indicated that 100 kg/ha gave least competition with respect to growth, grain formation and overall yield. The 100 kg/ha is the optimum seed rate for current aerobic rice production practice with respect to yield and overall growth.

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TABLE OF CONTENTS

CHAPTER ONE
INTRODUCTION

1.1 Background of Study

1.1.1 Rice Production System

Rice (*Oryza sativa*) belongs to the family Graminae, is the most important staple food crop worldwide. Rice is used by nearly half of the world population and it contributes on an average 20% of apparent caloric intake of the world population and 30% of population in Asian countries (Calpe and Prakash., 2007). In Malaysia, rice can be grown under two different growing conditions, lowland and upland. Lowland which is known as wetland is an irrigated bunded, partially or fully puddled field. The national average yield of lowland rice cultivation is about 3.3 tonnes per ha, but with modern high yielding varieties such as MR220 and MR219 the yield can attain up to 10 tonnes per ha (DOA., 2005). In addition, many lowland varieties have been continuously developed by MARDI for example MRQ76, MR253, MR263 and MR269 to sustain the local requirement. The upland rice refers to rice grown under rainfed, unbunded, field of undulated and dryland condition (Nori., 2003). Upland rice commonly cultivated in the upland area by rural communities in Sabah and Sarawak with cultivated area of 165, 888 ha (Hanafi et al., 2009). In general, upland rice produces low yield which is due to poor crop husbandary, pest and disease infestations and lack of water and mineral supplies (Mariam et al., 1991). Some examples of upland varieties are Lawi, Sarik, Kendinga, Siam, Kurau, Dusun, Paulok, Ukir and others (Hanafi et al., 2009; Musa et al., 2009). Total national rice production is roughly 22.4 million metric tonnes contributed by eight granary areas which are producing 60-65%of the domestic requirement (DOA., 2005).

1.1.2 Aerobic Rice

Aerobic rice is a new way to cultivate rice that requires less water than irrigated lowland rice and entails the direct seeding method in aerobic soil aiming at high yield (Mann et al., 2016). Aerobic rice refers to a cultivation system in which rice is seeded in well-tilled leveled fields with uniform slope under non-flooded and non-