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YIELD AND MORPHOLOGICAL PERFORMANCE OF FIVE MALAYSIAN RICE VARIETIES IN EIGHT DIFFERENT PLANTING DENSITIES

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BY

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

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DECLARATION

This project paper entitled **Yield and Morphological Performance of Five Malaysian Rice Varieties in Eight Different Planting Densities** is prepared by **Raba'a Binti Mohd Rawi @ Muhammad** and submitted to the Faculty of Agriculture in fulfilment of the requirement of PRT 4999 (Final Year Project) for the award of the degree of Bachelor of Agricultural Science.

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LIST OF ABBREVIATIONS

CV	Correlation of Variation
D1	Density 1
DAT	Days after transplanting
DOA	Department of Agriculture
df	Degree of freedom
EMS	Expected means square
FS	Filled spikelets
GA	Genetic advance
GCV	Genotypic coefficient of variation
GY	Grain yield
h^2_B	Broad-sense heritability
IRRI	International Rice Research Institute
LA	Leaf area
MARDI	Malaysian Agricultural Research and Development
MOA	Ministry of Agriculture and Agro-based Industry
MS	Mean square
NPm^{-2}	Number of panicles per m^2
P	Probability level
PCV	Phenotypic coefficient of variation
PH	Plant height
PL	Panicle length
SRI	System of rice intensification
r	Correlation coefficient
TDM	Total dry matter
TN	Tiller number per hill

$TNSP^{-1}$	Total number of spikelets per panicle
$YHill^{-1}$	Yield per hill
1000GW	1000-grain weight

ABSTRACT

Rice as staple food for the most worldwide population provides nutrition to human. Total production of rice in Malaysia is 2.75 million tonnes in 0.68 million hectares of area cultivated. Total production of rice in Malaysia is only about 62.4% of self suffiency level (SSL). However, Malaysia needs to achieve the SSL on 2020 by 70%. The objectives of this study were to determine the optimum planting density for five Malaysian rice varieties and the effects of planting densities on yield and morphological characteristics of rice varieties. Five Malaysian rice varieties are MR 219, MR 220, MR 253, MR 263 and MR269 were planted in eight planting densities with spacing of D1 (15 cm x 20 cm), D2 (15 cm x 25 cm), D3 (20 cm x 20 cm), D4 (15 cm x 30 cm), D5 (20 cm x 25 cm), D6 (20 cm x 30 cm), D7 (25 cm x 25 cm) and D8 (25 cm x 30 cm). This experiment was laid out in a split plot design, where density was assigned as main plot and variety was assigned as sub-plot with three replications. Seedlings with fifteen day-old were transplanted in the Field 10 on March 7, 2014 with single plant per planting point. Eleven data on yield and morphological traits recorded. Analysis of variance indicated significant differences between densities and varieties in all traits except for tillers number among varieties. Present of densities x varieties interaction for the panicle length while the remaining traits were absent. Density D2 found as the optimum planting density that produced the highest grain yield.

ABSTRAK

Beras sebagai makanan ruji bagi penduduk dunia. Jumlah pengeluaran beras di Malaysia 2.75 juta tan dengan 0.68 juta hektar kawasan penanaman. Jumlah pengeluaran beras di Malaysia tersebut adalah hanya kira-kira 62.4% daripada tahap sara diri negara. Walau bagaimanapun, Malaysia perlu mencapai SSL sebanyak 70% pada 2020. Objektif kajian ini adalah untuk mencari kepadatan tanaman yang optimum bagi lima jenis padi Malaysia dan kesan kepadatan pada hasil dan ciri morfologi varieti padi. Lima varieti Malaysia iaitu MR 219, MR 220, MR 253, MR 263 dan MR269 telah ditanam dengan lapan jarak tanaman yang berbeza jarak iaitu D1 (15 cm x 20 cm), D2 (15 cm x 25 cm), D3 (20 cm x 20 cm), D4 (15 cm x 30 cm), D5 (20 cm x 25 cm), D6 (20 cm x 30 cm), D7 (25 cm x 25 cm) dan D8 (25 cm x 30 cm). Eksperimen ini menggunakan reka bentuk plot perpecahan, di mana kepadatan tanaman sebagai plot utama dan variety adalah sub-plot dengan tiga replikasi. Anak benih berumur lima belas hari telah dipindahkan di Ladang 10 pada 7 Mac, 2014 dengan satu anak pokok bagi setiap titik penanaman. Sebelas data hasil dan ciri-ciri morfologi telah direkodkan. Analisis varians menunjukkan perbezaan yang signifikan di antara kepadatan tanaman dan varieti bagi kesemua ciri kecuali bilangan anak padi dikalangan varietiterdapat interaksi antara kepadatan tanaman x variety bagi panjang tangkai manakala ciri lain tiada interaksi. Kepadatan tanaman D2 didapati sebagai kepadatan tanaman optimum yang memberikan hasil bijirin yang tertinggi.

CHAPTER 1

INTRODUCTION

Rice (*Oryza sativa*) plays an important role as a staple food for the world, especially in south-east Asia where evident shows that rice was originally domesticated. Rice provides 20 percents of the dietary energy supply. In addition, it is good source of thiamine, riboflavin and niacin. The total rice production worldwide amounts to 719,738,273 tonnes (FAOSTAT, 2013). However, despite high production, the growing demand cannot be met due to increase in human population.

Almost 38 percent of the world's land surface is used for agriculture. Of this, 11 percent is arable land, 12 percent is permanent cropland and 26 percent is permanent pasture, but over the last 50 years, per capita agricultural area in the region as a whole has decreased by half (in 2009 the regional average was 0.2 hectares per capita)(FAO, 2012).

In Malaysia, rice production amounts to 2,750,404 tonnes per year (FAOSTAT, 2012) and this is still under self-suffiency level (SSL) target. Malaysia needs to achieve the SSL of 70% by 2015. Malaysia still depends on rice exportation from other country to supply the rice for Malaysian population. Therefore, there is a greater effort to overcome these problems by given more attention on agriculture in 10th Malaysia Plan. In this plan, there are four aspects that emphasize agriculture, the move is intended to increase the country's agricultural yield to reduce dependency on other countries in order to fulfil the food requirements the country.

Interest in growing rice at high population density has greatly increased in recent year, and considerable emphasis is being placed on breeding rice varieties that will assure a maximum and stable field under close spacing and heavy fertilization. Although many investigation have already been devoted to the problem at spacing. These however, become a problem to Malaysia due to the loose of areable paddy field to both domestic and industrial purposes. These circumstances reduced the planting area under rice cultivation. And there are no authorities to maintain the land abuse by the owner of the land. Insufficient areas for planting affect the production of rice for Malaysian population. Therefore this research is to study the maximum capacity of plant distance for high yield of paddy production. By determine the maximum capacity of plant distance, the problem with not enough land can be overcome. The planting densities affect the yield of rice production (Yoshida, 1979). Thereby, the number of tillers increases as decrease in plant distance. Rice is highly tolerant of plant densities, compare to wheat which is less tolerant and corn is the least tolerant (Yoshida, 1979).

Furthermore, the growth of crops are certainly depends on nutrient supplied, temperature, light radiation, moisture, and soil fertility that will affect the yield production of the crops in the dense or loose area of crop field (Baloch *et al*., 2002). According to Yoshida (1979), within the critical temperatures, temperature will affects grain yield by affecting tillering, spikelet formation, and ripening of paddy plant although there are optimum temperature for different physiological process, that affect vary between variety. After germination, growth rate of the plant will affect greatly by temperature.

Moreover, the requirement of solar radiation is different from one stage to another and can affect the yield production. Shading during the vegetative stage

slightly affects yield and yield components. However, shading during the reproductive stage has effect on spikelet number and can reduce the grain yield during ripening due to decrease in the percentage number of filled spikelet. The problems caused by shading can be reduce by determine the maximum planting density. This study was conducted to determine the maximum planting density for high production of crops yield on limited planting area.

1.1 OBJECTIVES:

1) To determine the optimum planting density for high yield of each five Malaysia's rice varieties.
2) To study the effects of planting densities on growth and morphological characteristics of rice varieties.
3) To estimate genetic variance components.
4) To determine the relationship among yield and morphological characteristics.

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