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Techniques of Water Saving in Rice Production in Malaysia

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Abstract: "More crops per drop" concept is a growing interest in rice cultivation. An experiment was carried out to determine the effect of reducing water on rice production and to investigate the temporal changes in chemical properties in soil solution. There were five treatments simulating different flooding depths and durations during the rice-growing period namely; W_1 (continuous flooding at 5 cm); W_2 (continuous flooding at 1 cm); W_3 (continuous flooding at 5 cm in the first 3 weeks then 1 cm flooding); W_4 (continuous flooding at 5 cm in the first 6 weeks then 1 cm flooding) and W_5 (continuous flooding at 5 cm in first 9 weeks then 1 cm flooding) with 4 replications. Different water saving techniques did not any effect on rice yield and yield components.

Key words: Water saving techniques, rice yield

INTRODUCTION

Rice is the most important staple food in Asia, providing an average of 32% of total calorie uptake[1]. Approximately, 576 million tons per year rice produced globally, 90-91% is produced and consumed in Asia[2]. The Malaysian scenario shows that the increase in rice production is not parallel with the increase in the country's population. In order to meet the demand, rice is imported from neighboring countries, with the amount valued at about RM 501 million per year as reported by Asian Food Security Information System[3]. Increased productivity with optimum input should be the direction forward. One of the major inputs for rice production is water. About 75% of the global rice volume produced is in the irrigated lowlands[1]. The increase in total irrigated crop area has increased the demand for water. In Asia, irrigated rice account for about 50% of the total amount of water diverted for irrigation, which in itself accounts for 80% of the amount of fresh water diverted[4]. Per capita availability of water resources has declined by 40-60% in many Asian countries between 1955 and 1990[5]. In fact, in Malaysia, water supply coverage grew rapidly between 1990 and 1995 (3.74% per annum) that Malaysia achieved its goal of providing 89% of its population with safe drinking water by 1995. The overall water demand is growing at the rate of 4% annually and projected to be about 20 billion m^3 by 2020 and the annual domestic and industrial water demand will grow to 5.8 billion m^3 and the irrigation water demand to about 13.2 billion m^3 in 2020[6]. The current study attempts to look into the potential of producing rice under low water input. In consideration with this current issue, this study attempted to find the effect of different flooding regimes on rice yield.

MATERIALS AND METHODS

An experiment was carried out in the field at Universiti Putra Malaysia to evaluate the effect of low water input for rice production. The experiment was laid out in a Completely Randomized Design (CRD) consisting of 5 different flooding levels with 4 replications. The 90 cm cylindrical culvert with closed bottom was used in this experiment and soils were filled at 40 cm depth from 20 cm below the brim to facilitate the water application. There were made two holes controlling by regulators at 1 cm and 5 cm above from the soil level to maintain of water levels according to the treatment. Fertilizers were applied Urea 110 kg ha^{-1} as N with 2 splits 2/3 as basal + 1/3 at active tillering, P_2O_5 (60 kg ha^{-1}) as Triple Super Phosphate (TSP) and K_2O (65 kg ha^{-1}) as Muriate of Potash (MOP). Compound fertilizer (N: P: K= 12:12:17) was applied twice at 50 and 71 days after planting at the rate of 300 and 200 kg ha^{-1}, respectively. At maturity, the number of tiller and panicle per plot were recorded. The difference in the grain and straw yield was recorded. The panicle and straw were oven-dried at 60-70°C to constant weight and straw weight was recorded. The panicles were threshed and weight. The filled grain was separated from unfilled grain using salt solution using1.06 specific gravity. The filled

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Table 1: Yield and yield components of rice plant grown under different flooding regimes

Treatments	Tiller number/m^2	Panicle number/m^2	Unfilled grain/panicle	Filled grain/panicle	1000 seeds weight (g)	Straw yield (t ha^{-1})	Dry filled grain (t ha^{-1})
W_1	691a	657a	20a	93a	27.7a	14.28a	12.39a
W_2	695a	665a	26a	92a	27.2a	14.46a	11.87a
W_3	682a	647a	24a	89a	27.8a	13.44a	12.23a
W_4	679a	641a	19a	93a	27.4a	13.15a	12.27a
W_5	674a	636a	23a	101a	27.2a	13.48a	12.24a

Means with the same letter are not significantly different in column at $p \leq 0.05$ by DMRT

grain was washed, oven-dried, weighed and counted. The second hill in the middle row was collected to count filled grain per panicle, unfilled grain per panicle and weight of 1000 seeds was determined. The data was analyzed for analysis of variance (ANOVA). The means were compared using Duncan's Multiple Range Test (DMRT) using the Statistical Analysis System software version 6.12[7].

RESULTS AND DISCUSSION

There were no significant difference of tiller numbers, panicle numbers, yield t/ha, straw yield t/ha, unfilled grain/panicle, filled grain/panicle and 1000 seeds weight (g) respect to different water saving irrigation systems (Table 1). The tiller and panicle number was in the range of 674 to 695 and 636 to 665, respectively. The panicle number had a relation with the tiller number and the panicle number is higher in treatments, which were showed higher tiller number. The filled grains per panicle were in the range of 89 to 101, although Malaysian Agricultural Research and Development Institution[8] were reported 88 grain per panicle. Increased the filled grain might be effect of the contribution of carbohydrate from current photosynthesis might be more and efficiently translocated into grain and thus increased the grain yield[9]. The number of unfilled grain per panicle was in the range of 20 to 26. In this study, the 1000's seed weight was 27.13 and 27.70 g as similar to MADRI was 27.11 g[8]. The straw weight was found to be ranged between 13.15 to 14.46 t ha^{-1}. Yield was in the range of 12.39 to 11.87 t ha^{-1}. The overall grain (14% moisture content) was around 12 t ha^{-1}; however, MARDI[8] was estimated 10.70 t ha^{-1} in same rice variety MR219 at MARDI rice research station Tanjang Karang, Selangor. MARDI[8] also reported that to achieve 10 t ha^{-1} yield must be achieved 500 panicles per square meter. In this research, the panicle number was estimated more than 600 per square meter; therefore, the yield was increased up to a level of 12 t ha^{-1}.

This study clearly shows that it is highly possible to produce rice under low water saving technique, which may capable of saving water between at least 25-30%. Therefore, the surplus water could use for municipal and industrial purposes for getting 100% self sufficient of country demand.

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