EFFECT OF WATER MANAGEMENT AND SPACING ON GROWTH AND YIELD OF RICE

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Introduction

Irrigated rice production is the largest consumer of water in the agricultural sector, and accounts 75% of global rice production. In many areas, irrigated rice fields are kept continuously flooded and drained only at the time of harvest. Increasing water scarcity for irrigation is threatening the sustainability of lowland rice production in many parts of the world. On the other hand, under flooded conditions, most of the water input to a rice field is to compensate for unproductive outflows such as evaporation, seepage and percolation during land preparation and the crop growth period which do not contribute to crop growth and yield formation. Improving water use efficiency, and water productivity which considers yields or income per m^3 of water consumed at all levels is therefore, becomes vital for the sustainability of lowland rice cultivation. Reducing water during crop growth period is one of the water saving management options in irrigated lowland rice systems to improve rice water productivity. Shallow water management can be regarded as one of the alternatives to use water efficiently, achieve good yield and minimize the methane emission from the rice fields.

Materials and Methods

The field experiments were conducted at Yamagata University Experimental Farm in 2009/10 considering shallow and conventional water managements. Two Spacing as wider(30×30cm) and narrow(30×15cm) were included to find whether wider spacing by reducing seed rate by halves can really compensate the yield of narrow spacing. The purpose of inclusion of two varieties Sasanishiki (panicle number type-source limited)) and Haenuki (panicle weight type-sink limited) was to observe the effect of water management and spacing on yield parameters due to their differences in morpho-physiological characteristics.

Result and Discussion

1. The average maximum and minimum soil temperatures at 5cm depth in shallow water management were significantly different with conventional during vegetative period but not in reproductive and maturity periods for maximum and reproductive for minimum temperature. The maximum temperature was higher whereas minimum temperature was lower in shallow than conventional water management. The mean temperature in both the water management plots was not different during entire growth period.
2. No significant different was found between water management and spacing for available exchangeable ammonium. However, nitrate nitrogen at 39DAT was higher and significantly different in shallow water management than conventional. Significant different between water management with higher value in shallow water was found at 49, 58 and114DATs and between spacing with high value in narrow spacing was observed during all period except for 86DAT for plant nitrogen uptake. The leaf area index was significant different between the spacing having higher in narrow at 49DAT.At 58DAT, significant different was measured between water management as well as spacing having higher value in shallow water and narrow spacing. There was not significant different between water management practices but at 58 and 86DATs between the spacing with higher value in wider spacing for relative growth rate. Significant different between water management practices for crop growth rate at 58DAT with higher value in shallow water and between spacing with more value in narrow at 49 and 114DATs.Significant different was found between water management practices with higher value in shallow water at 58,86and 114DATs and spacingwith higher value in narrow spacing during entire period for dry matter production.
3.There was no significant different in other yield parameters and yield between water management practices except harvest index, grain- straw ratio, filled spikelets% and brown rice weight with higher value in shallow water. Significant different was found between spacing for no. of paniclesm-^{2}(narrow>wider), spikeletspanicle-^{1}, harvest index, and grain- straw ratio (wider>narrow) in Sasanishiki. In case of Haenuki, there was no significant different in yield and yield components between water management practices except for no. of paniclem-^{2}with higher value in shallow water. Significant different was found between spacing for spikeletspanicle-^{1}and harvest index (wider>narrow), no of paniclesm-^{2}and paddy &brown rice yield (narrow>wider).

Conclusion

The yield differences between conventional and shallow irrigation in Haenuki was relatively less than Sasanishiki. This indicates that water stress has some impact on sink limited varieties and thus water saving irrigation may be more suitable for source limited varieties. The yield of Haenuki with high plant density was higher than the yield of low planting density and with Sasanishiki such effect was less observed. The relatively lower yield in wider spacing than narrow indicates to reconsider the planting density and plant spacing of 30×30cm^2 seems more wide even for source limited variety.Therefore,proper planting distance and pattern should be taken into consideration to achieve better yield in water saving rice cultivation for both source and sink limited cultivars. Shallow water management treatments showed little higher yield over conventional, although statistically not significant but this slight increment has great importance for raising water productivity and food production