Effects of Regulated Deficit Irrigation and Partial Root Drying on Yield, Yield Components and Water Productivity of Rice in Furrow and Basin Methods

M. Yousefian, A. Shahnazari¹, M. Ziatabar Ahmadi, M. Raeni Sirjaz , and B. Arabzadeh

PhD. student, Sari Agricultural Sciences and Natural Resources University.
mostafa_yousefian@yahoo.com
Associate Professor, Water Engineering Department, University of Agricultural Sciences and Natural Resources of Sari. aliponh@yahoo.com
Professor, Water Engineering Department, Sari Agricultural Sciences and Natural Resources University.
mzahmadi@yahoo.com
Professor, Water Engineering Department, Sari Agricultural Sciences and Natural Resources University.
raeini@yahoo.com
Assistant Professor of Rice Research Institute.
beh_arabzadeh@yahoo.com

Abstract

Due to drought crisis in recent years, the use of alternative cropping methods that save water without any decrease in yield is increasing. Therefore, in order to evaluate the yield, yield components, and water use of rice under different non-submerged water levels and comparing it with permanently submerged condition, an experiment was conducted at fields of Rice Research Institute of Mazandaran during 2015 and 2016, using a randomized complete block design with three replications. The treatments consisted of two methods, regulated deficit irrigation (RDI) by irrigating all furrows and partial root drying (PRD) by irrigating alternate furrows, with three levels of drought stress: 10, 30, and 60 KPa (RDI10, PRD10, RDI30, PRD30, RDI60, PRD60) and a control treatment with permanently submerged basin irrigation in puddled soil (traditional method). Rice yield, yield components, and water consumption were measured in each treatment. The results showed that yield, plant height, panicle length, number of grains, 1000-grain weight, and water productivity (kg/m³) and water consumption at different levels of irrigation had a statistically significant difference in different treatments. Although the highest yield of rice was obtained in continuous submergence, yield reduction in alternate furrow irrigation treatments with minor stress (RDI10 and PRD10) was negligible and they were in the same statistical group in the two years of study. Also, partial root drying, significantly reduced water consumption, such that PRD10 treatment resulted in 32% reduction in water consumption compared to the control treatment, and deficit irrigation, especially partial root drying, increased water productivity. The highest water productivity (kg/m³) was calculated in PRD30 treatment at 0.724 kg per cubic meter of water. Based on the results, water consumption in the partial root drying was less than regulated deficit irrigation with the same tension, such that water consumption in PRD10 decreased by 15% compared to RDI10. However, average yield of PRD10 in both years was 1.1% higher. The results related to the yield components were also proportional to yield and partial root drying method compared to regulated deficit irrigation was better.

Keywords: Alternate furrow irrigation, Partial root drying, Rice deficit irrigation

¹- Corresponding author, Sari Agricultural Sciences and Natural Resources University, Faculty of Agricultural Engineering-Water Engineering Department, Sari, Iran
o- Received: December 2017 and Accepted: August 2018