



## Effects of deficit irrigation and groundwater depth on root growth of direct seeding rice in a column experiment

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Received 19 March 2014; Accepted after revision 23 May 2014; Published online 20 August 2014

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### Abstract

Rice is an essential crop in Iran that is grown mostly in areas where depth to groundwater is low. Root growth and water uptake of rice under shallow groundwater has not been thoroughly studied. This experiment was conducted to determine the lowland rice (cv. Ghasrodashti) root distribution above shallow groundwater in relation to deficit irrigation and groundwater depth in cylindrical greenhouse lysimeters. The irrigation treatments were continuous flood irrigation (CFI) and intermittent flood irrigation (4- and 8-day intervals IF-4 and IF-8). The groundwater depths (GWD) were 0.3, 0.45 and 0.6 m from the soil surface. In general, 40-60% of root dry weight was observed in the top 10 cm of soil in CFI treatments and IF-4 with 0.3 m GWD resulted in 20% increase in root dry weight in 10-20 cm layer compared with 0-10 cm. However, the root dry weight in 0-10 cm at 0.60 m GWD was 58% lower in intermittent irrigation compared to CFI. There was no significant difference in mean root length density in IF-4 with 0.3 m GWD compared with CFI. In general, lowland rice showed good ability to develop its root system in shallow groundwater level conditions in order to extract water due to lower soil water content in the intermittent flood irrigations. Simple equations were presented to predict the groundwater contribution to evapotranspiration based on the root length density and root weight density. Therefore, in areas with shallow groundwater depth (up to 0.45 m from the soil surface) and low potential evapotranspiration, application of IF-4 instead of CFI can be useful management especially where water scarcity is a serious problem.

**Keywords:** Groundwater; Root yield; Root length density; Intermittent flood irrigation; Continuous flood irrigation.

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