

## Investigation of Flooding Water Depth Management on Yield and Quality Indices of Rice Production

H.R. Salemi<sup>1</sup>- A.R.Tavakoli<sup>2\*</sup>

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**Introduction:** Water crisis as a major limitation factor for agriculture, like other arid and semiarid regions exists in Isfahan province which is located in the central part of the Zayandehrud River Basin (ZRB). Rice appears to be the far-most profitable crop but at the same time it has a major impact on basin scale water resources, especially affecting downstream farmers. In the study area (ShahidFozveh Research Station), the water resources for agricultural production face heightened competition from other sectors like industry and domestic use. This necessitates considering different crops, altered agricultural systems and innovative methods that can reduce the water requirements for the irrigation of rice. The Alternative Wetting and Drying (AWD) seems to be an effective method reducing water use for rice crops and possibly save the water for downstream users. There have been no qualitative evaluations of rice production under deficit irrigation practices in Isfahan area. This study sought to determine, under study area conditions, the quantities of water irrigation used with AWD practices, the resulting water productivity (WP) and the effects of alternative irrigation management on yield, quality indices and rice production performance.

**Materials and Methods:** The ZRB (41,500 km<sup>2</sup>) is a closed basin with no outlet to the sea. The research was conducted in the Qahderijan region of Isfahan province, which is located in the central part of the ZRB. The ShahidFozveh Agricultural Research Station (32° N, 51° E) is located at the altitude of 1612 m above the sea level. In order to improve WP and illustration of the impact of various levels of flooding depth on grain yield and quality indices at rice production, a field experiment (3000 m<sup>2</sup>) was conducted at ShahidFozveh Research Station for 2 years arranged in a split plot design with three replications. It will be necessary to use different scenario of water flooding depth management to achieve the highest irrigation application efficiency and WP. The treatments included: three levels of irrigation managements I<sub>1</sub>: permanent flooding under 3.5 cm water during growth period, I<sub>2</sub>: permanent flooding under 2.2cm water during growth period and I<sub>3</sub>: 0-1.5cm. AWD were considered as main plots and eight advanced rice cultivars (Geredmahali, Zayandehrud, Sazandegi, Hasani, 67-97, 67-113, 67-47 and 67-72) as sub plots. The treatments were compared based on grain yield and quality indices for irrigation management and rice varieties including: amylose content (AC), Gelatinization temperature (GT) and gel consistency (GC). Production (grain yield), quality indices, the consumption water, WP and cultivars reactions to different irrigation management were evaluated in different treatments. The soil of the experimental area, according to USDA Soil Taxonomy 1994 is of FINE CLAYEY. At the soil depth of 1m, soil salinity (6.2 dS.m<sup>-1</sup>), water salinity (3.9 dS.m<sup>-1</sup>), and soil moisture at saturated capacity (48 Vol. %) at the field site were measured or experimentally obtained in the Isfahan Soil and Water Laboratory. The results were subjected to an ANOVA to analyze the effects of the treatments and their interactions using PROC GLM (SAS 9.1, SAS institute Ltd., USA). Duncan's multiple range tests at 0.05 probability level was used for paired mean comparison.

**Results and Discussion:** Results showed that water flooding depth treatments had significant effect on gel consistency, gelatinization degree and WP (P<0.01). Significant differences (P<0.01) were noticed in Gelatinization degree, gel consistency, grain yield, WP among the cultivars. Also cultivars have significant effect (P<0.05) on amylose contents. The highest magnitude of WP was calculated 0.91kg.m<sup>-3</sup> for (I<sub>3</sub>) followed by Zayandehrud, 67-113 and Sazandegi with 0.86 and 0.85, respectively. Maximum WP obtained from AWD irrigation management and Zayandehrud rice variety, its amount was 9.1kg.mm<sup>-1</sup>. At this treatment with 33.4 percent reduction of irrigation water, have resulted only 11.1 percent decreased of paddy grain yield. Results showed that it is not necessary to maintain the rice field submerged in whole growth period. Considering the importance of water flooding depth optimization as the main scope in arid and semi-arid lands of Iran, (I<sub>3</sub>) is recommended.

**Conclusion:** During the two years of conduction of an experiment in ZRB with clay texture and mild saline

1- Assistant Professor of Agricultural Engineering Research Department, Isfahan Agricultural and Natural Resources Research and Education Center, (AREEO), Isfahan, Iran

2- Assistant Professor of Agricultural Engineering Research Institute (AERI), Agricultural Research, Education and Extension Organization (AREEO), Karaj, Iran

(\* - Corresponding Author Email: art.tavakoli@gmail.com)

water with the three (3) irrigation treatments imposed on the rice crop. The highest WP was achieved for (I<sub>3</sub>) followed by Zayandehrud, 67-113 and Sazandegi, respectively. It was found that the AWD irrigation management, despite its lower yield than other irrigation treatments, increased water productivity. Thus, this treatment is desirable therefore highly recommended for agricultural rice production in arid region.

**Keywords:** Isfahan, Quality indices, Water consumption, Water stress

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