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Soil Matric Potential Based Irrigation in Rice: A Solution to Water Scarcity

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Abstract : The current focus in irrigated agriculture will move from maximizing crop production per unit area towards maximizing the crop production per unit amount of water (water productivity) used. At the same time, inadequate water supply or deficit irrigation will be the only solution to cope with water scarcity in the near future. Soil matric potential based irrigation plays an important role in such deficit irrigated agriculture to grow any crop including rice. Rice as the staple food for more than half of the world population, grows mainly under flooded conditions. It requires more water compared to other upland cereals. A major amount of this water is used in the land preparation and is lost at field level due to evaporation, deep percolation, and seepage. A field experimental study was conducted in the experimental premises of rice research and development institute of Sri Lanka in Kurunegala district to estimate the water productivity of rice under deficit irrigation. This paper presents the feasibility of improving current irrigation management in rice cultivation under water scarce conditions. The experiment was laid out in a randomized complete block design with four different irrigation treatments with three replicates. Irrigation treatments were based on soil matric potential threshold values. Treatment W0 was maintained between 60-80mbars. W1 was maintained between 80-100mbars. Other two dry treatments W2 and W3 were maintained at 100-120 mbar and 120 -140 mbar respectively. The sprinkler system was used to irrigate each plot individually upon reaching the maximum threshold value in respective treatment. Treatments were imposed two weeks after seed establishment and continued until two weeks before physiological maturity. Fertilizer applications, weed management, and other management practices were carried out per the local recommendations. Weekly plant growth measurements, daily climate parameters, soil parameters, soil tension values, and water content were measured throughout the growing period. Highest plant growth and grain yield (5.61t/ha) were observed in treatment W2 followed by W0, W1, and W3 in comparison to the reference yield (5.23t/ha) of flooded rice grown in the study area. Water productivity was highest in W3. Concerning the irrigation water savings, grain yield, and water productivity together, W2 showed the better performance. Rice grown under unsaturated conditions (W2) shows better performance compared to the continuously saturated conditions(W0). In conclusion, soil matric potential based irrigation is a promising practice in irrigation management in rice. Higher irrigation water savings can be achieved in this method. This strategy can be applied to a wide range of locations under different climates and soils. In future studies, higher soil matric potential values can be applied to evaluate the maximum possible values for rice to get higher water savings at minimum yield losses.

Keywords : irrigation, matric potential, rice, water scarcity
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