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EXTENDED ABSTRACT

The Effect of Sprinkler Irrigation on Grain Yield, Yield Components and Water Use Efficiency of Rice Cultivars under Drill-Seed Cultivation in Khuzestan

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Introduction

Water scarcity is a major constraint in the development of rice farming in some parts of the world. In many areas, the volume of water consumed in the field and during the growing season of rice is usually more than the actual requirement due to traditional flood irrigation. In the province of Khuzestan, irrigation water requirement is potentially high due to the coincidence of rice cultivation with the beginning of hot months of the year. In traditional irrigation management, regular water entry and exit from the basins is commonly used to reduce water temperature and create a cool environment for plant development. This system causes a lot of water losses. It seems that a change in the irrigation method of rice fields is necessary. The application of new technologies, such as pressurized irrigation systems, can be an appropriate approach to reduce future problems related to increasing water shortages. In this regard, the study of pressurized irrigation systems has been considered as one of the strategies for reducing water consumption and increasing water productivity in rice cultivation in the research program. Result of a research in Pakistan about water use efficiency and economic feasibility of growing rice with sprinkler irrigation showed that the application of this system increased the yield of rice by 18%, while the water consumed was 35% less than the traditional irrigation system (McCauley, 1990).

Materials and Methods

This research was carried out to determine the reaction of rice cultivars to water regimes in the sprinkler irrigation system. This experiment was performed as split plot in RCB design with three replications for two years (2002-2003) in Shavour research station as a branch of Khuzestan Agricultural and Natural Resources Research and Education Center. Water regimes were the main plots in three levels (75%, 100% and 125% of crop water requirement) and rice cultivars were as subplots (three high-yielding and three local cultivars namely Red Anbouri, Champa-16, and Champa-6). The cultivation method was drill-seed in which the seeds were buried in holes of 3 or 4 centimeters of depth in plots with 11*11 m2 in size. The irrigation of the farm was carried out by designing and installing a network of polyethylene pipes and using VYR80 part circle sprinklers (adjustable to full-circle) with a spray diameter of 22 meters. For each plot, four

sprinklers were considered on four corners. Water measurement in plots was done by volume meter. Irrigation was carried out on a daily basis. The combined analysis showed that there was a significant differnce in yield between a certain year and its reaction with water regime (1%) and also cultivars (5%) but there were no differences in other cases. The highest grain yield belonged to the second year with an average of 3164 kg/ha. The grain yield increased from 2572 to 2860 kg/ha as a result of changing the level from 75% to 125%. Among the cultivars, Champa-16 produced the highest grain yield (3035 kg/ha).

Results and Discussion

Combined analysis showed a significant difference between the year and its interaction with variety at 1% level and rice varieties at 5% level. According to the comparison of the averages, the highest grain yield with an average of 3164 kg / ha was related to the second year. Among the irrigation levels of 75% and 125%, grain yield increased to 288 kg/ha after increasing water consumption in 125% irrigation regime to 9112 m^3 . Comparison of the means for rice varieties showed that the highest grain yield was for Champa-16 with an average of 3035 kg/ha. The interaction between variety and year indicates that all varieties had more yield in the second year, the highest seed yield being related to Gachsaran-5 and Gachsaran-7, followed by the local varieties of Red Anbouri and Champa-16.

The volumes of water consumed at the irrigation levels of 125, 100 and 75% of water requirement in the first year were 18, 14.4 and 11.5 thousand cubic meters per hectare. In the second year, however, these quantities were 28.9, 22.8 and 17.2. The difference in water consumption between the two years was related to the differences of evaporation which had been measured from class A pan placed in the vicinity of the project field so that in the first and second years, the evaporation from class A pan were 1121 and 1605 mm, respectively, during the growing season.

Conclusion

Changes in grain yield indicated that, in proportion to the increase in water, the grain yield in this range of irrigation regime had a linear upward trend. The difference of yield response of varieties to sprinkler irrigation system was high. Under such sysytems, irrigation of local varieties is more beneficial than new high yielding varieties. The slope of the increase in yield, proportional to the increase in water consumption, indicates the greater sensitivity of the farm to changes in water levels in the sprinkler irrigation system.

Regardless of whether or not rice cultivation in Khuzestan is scientific, it is possible to use a sprinkler irrigation system without the physiological limitations of the existing varieties. However, it requires research that involves socio-economic aspects as well. The sprinkler irrigation system in this research was adapted to the experimental design under irrigation with a one-day interval. For feasibility studies in farmer's conditions, additional research is necessary with regard to practical aspects.

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