

## Effects of soil water conditions and organic and chemical fertilizers on growth characteristics and water use efficiency of rice in an alkaline non-calcareous soil

M. Abbasi<sup>1</sup>, N. Najafi<sup>1\*</sup>, N. Aliasgharzad<sup>1</sup> and Sh. Oustan<sup>1</sup>

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### Abstract

In a greenhouse research, the effects of soil water conditions, sewage sludge and chemical fertilizers on growth characteristics and water use efficiency of rice (*Oryza sativa* L. cv. Ali Kazemi) were studied in a loamy sand alkaline non-calcareous soil. The study was performed as a factorial experiment in a randomized complete blocks design including soil water conditions in three levels (continuous submergence, alternate submergence and alternate saturation) and source and amount of organic and chemical fertilizers in 10 levels [control, 100% chemical fertilizers (434.8 mg urea, 66.1 mg  $\text{KH}_2\text{PO}_4$ , 40 mg KCl, 50 mg  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ , 38.5 mg  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ , 21.3 mg  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  and 7.9 mg  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  per kg of soil), 20 g sewage sludge per kg of soil with and without 50% of chemical fertilizers, 40 g sewage sludge per kg of soil with and without 50% of chemical fertilizers, 20 g poultry manure per kg of soil with and without 50% of chemical fertilizers and 40 g poultry manure per kg of soil with and without 50% of chemical fertilizers] with three replications. At the end of growth period, tiller and leaf number per plant, length and diameter of stem, length and volume of roots, and shoot and root dry matter were measured and water use efficiency (WUE) was calculated. The results showed that application of 20 and 40 g poultry manure per kg of soil prevented the growth of rice due to increase of soil salinity. Application of 20 and 40 g sewage sludge per kg of soil increased significantly tiller and leaf number per plant, length and diameter of stem, length and volume of roots, shoot and root dry matter and WUE compared to control and 100% chemical fertilizers treatments. Addition of 50% chemical fertilizers to 40 g sewage sludge per kg of soil did not significantly affect tiller and leaf number per plant, stem length, volume of roots, shoot dry matter and WUE of rice. The highest tiller number per plant, stem diameter, root length and the ratio of shoot dry matter to that of root were observed in continuous submergence treatment. The highest WUE of rice plant was in alternate saturation treatment. The effect of soil water conditions on plant height, leaf number per plant and shoot dry matter was not significant. In general, alternate saturation with application of 40 g sewage sludge per kg of soil could be recommended to achieve optimum growth of rice plant and increase of WUE.

**Keywords:** Yield components of rice, Sewage sludge, Poultry manure.

1. Soil Sci. Dept., College of Agric., Univ. of Tabriz, Tabriz, Iran.

\*: Corresponding Author, Email: n-najafi@tabrizu.ac.ir