Determination of the Relationships between Yield and Evapotranspiration of Maize under Salinity Stress and Nitrogen Deficiency Conditions

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Abstract

In this study, yield and evapotranspiration of maize (cv. SC 704) were investigated under salinity stress and nitrogen deficiency. The experiment was carried out in a randomized complete block design. Electrical conductivities of saline water treatments were 0.5(S0), 2.1(S1), 3.5(S2), and 5.7(S3) dS.m⁻¹. Nitrogen deficiency treatments were 100% (F0), 75% (F1), 50% (F2), and 25% (F3) of nitrogen fertilizer requirement based on soil testing. The treatments were carried out in three replications and in plots with area of 9 m². In different treatments, evapotranspiration of maize was between 220 to 349 mm and dry matter yield between 9.4 to 15.2 ton.ha⁻¹. With increase in the salinity levels in F0, F1, F2, and F3 treatments, the slopes of yield function were estimated as 0.2, 0.207, 0.218, and 0.231, respectively. Also, with reduction of nitrogen at salinity levels of S0, S1, S2 and S3, the slopes were estimated as 0.175, 0.182, 0.194 and 0.221, respectively. The results showed that, with increasing stresses, yield of maize decreased more than evapotranspiration. The coefficient of \( K_y \) was calculated using the Doorenbos-Kassam relationship. With reduction of nitrogen at salinity levels of S0, S1, S2 and S3, values of \( K_y \) coefficient were estimated as 1.01, 1.048, 1.119, and 1.272, respectively. Also, with increase in the salinity at nitrogen levels of F0, F1, F2 and F3, \( K_y \) values were estimated as 1.15, 1.19, 1.258, and 1.328, respectively. On the average, \( K_y \) was calculated as 1.27. Under the highest stress (S3F3), water and nitrogen use efficiency decreased by: 38% and 34.5%, respectively, compared to the control treatment (S0F0). The results showed that the water requirement and yield of maize under the mentioned stresses were less than the region’s potential. Under these conditions, by supplying soil nitrogen and reducing water use, water resources will be used optimally and yield will increase.

Keywords: Coefficient of yield function, Doorenbos-Kassam relationship, Water and nitrogen use efficiency

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