International Journal of Plant Production 8 (1), January 2014
ISSN: 1735-6814 (Print), 1735-8043 (Online)
www.ijpp.info

GUASNR

Maize response to different water, salinity and nitrogen levels: agronomic behavior

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Received 3 September 2012; Accepted after revision 13 August 2013; Published online 25 November 2013

Abstract

Soil water, salinity and nitrogen content are three major factors affecting crop production in arid and semi-arid areas. This study was performed in two years of 2009 and 2010 in a semi-arid area in order to investigate the effects of irrigation water quantity (as main plot), quality (saline water, as sub-plot), nitrogen fertilizer (as sub-sub plot) and their interactions on growth and yield of maize hybrid SC-704. The experimental design was split plot with three replications. Irrigation treatments consisted of I_1 (1.0 crop evapotranspiration (ET_c) + 0.25ET_c as leaching), I_2 (0.75I_1) and I_3 (0.5I_1) applied at 7-day intervals. The salinity treatments were 0.6 (fresh water), 2.0 and 4.0 dS m^{-1}. There were also three nitrogen (N) treatments including 0, 150 and 300 kg N ha^{-1}. The results showed that maize under water and salinity stress had longer vegetative stage period by 11 and 16% compared to the control, respectively. The most sensitive trait under water, salinity and nitrogen stress was grain yield (GY) which reduced by 52.3, 25.2 and 28.0%, for treatments of 0.5I_1, 4.0 dS m^{-1} and 0 kg N ha^{-1}, respectively. Based on water productivity (WP), applied water is more efficient for GY production under lower irrigation and N fertilizer usage. Grain yield surface function approached a maximum under I_2 and I_1 treatments in response to increasing water and N levels. The contour plots of GY were developed at each salinity level and showed that it could be a useful management device of irrigation and N for maize GY. Based on nitrogen use efficiency (NUE) and nitrogen recovery (NR), the N application rate of 150 kg ha^{-1} was the optimum rate for the study region especially under saline water conditions. Further, interaction result of the experimental factors showed that with adequate or limited fresh water supply, application of higher N rate (300 kg ha^{-1}) yielded higher GY. While under saline