EFFICACY OF MACRONUTRIENTS (K, CA & MG) IN MITIGATING SALT DAMAGES IN RICE (*Oryza Sativa* L.)

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Executive Summary

Salt stress causes significant damage to the rice plant. The diverse role of calcium (Ca), potassium (K) and magnesium (Mg) as nutrient is well known but their role in mitigating salt stress in plants was not studied extensively. For this, An experiment was conducted in the experimental shed and in the Laboratory of Department of Agricultural Botany of Sher-e-Bangla Agricultural University, Dhaka during the period of November, 2017 to June, 2018 to evaluate the response of *Oryza sativa* L. cv. BRRI dhan67 to salt stress and the role of calcium (Ca), potassium (K) and magnesium (Mg) supplementation in mitigating salt damage. Three sets of experiments were conducted. In one experiment, the treatments consisted of four different salinity levels viz. S0= without salt/control (0 dSm^{-1}), S_1= 4 dSm^{-1}, S_2 = 6 dSm^{-1}, S_3= 8 dSm^{-1}, and three different levels of calcium viz. Ca0= 0 ppm, Ca1= 80 ppm and Ca_2 = 160 ppm. The treatments were S_0Ca_0, S_0Ca_1, S_0Ca_2, S_1Ca_0, S_1Ca_1, S_1Ca_2, S_2Ca_0, S_2Ca_1, S_2Ca_2, S_3Ca_0, S_3Ca_1 and S_3Ca_2. Other experiment consisted of different levels of potassium (K_1=80 ppm and K_2=160 ppm) which were supplemented with different levels of salinity; treatments were S_0, S_1, S_1K_1, S_1K_2, S_2, S_2K_1 and S_2K_2. In another experiment, magnesium (Mg_1=80 ppm and Mg2=160 ppm) was added with different salinity levels; this experiment consisted of various treatments including S_0, S_1, S_1Mg_1, S_1Mg_2, S_2, S_2Mg_1 and S_2Mg_2. The experiments were laid out in Randomized complete Block Design (RCBD) with three replications. Different growth, development, physiological, reproductive, yield components and yield were adversely affected under salt stress. More damaging affect was noticed with the increase of salinity levels. Salt affected rice plants showed the decreased plant height, number of tillers $plant^{-1}$, number of effective tillers $plant^{-1}$, leaf area and decreased root length. Salt stress caused oxidative damage which is indicated by the decrease of leaf membrane stability in rice plants under different levels of salt stress. Due to salt-induced osmotic stress the relative water content (%) decreased. Salinity results in chlorophyll destruction which reduced SPAD value of rice plants. Days to flowering, panicle length (cm), number of filled grains $panicle^{-1}$, filled grains $panicle^{-1}$, 1000 grain weight decreased in salt affected plants. As a result the grain yield $plant^{-1}$ decreased. Without the yield leaf dry weight $plant^{-1}$, root dry weight $plant^{-1}$, shoots dry weight $plant^{-1}$ and total dry weight $plant^{-1}$ also showed decreased pattern under salt stress. Among different levels of salinity (S_1= 4 dSm^{-1}, S_2 = 6 dSm^{-1}, S_3= 8 dSm^{-1}), rice plants showed the highest damaging effect in all aspects at 8 dSm^{-1} of salt stress. Supplementation of Ca, K and Mg alleviated the damaging effect of salt stress to some extent. Exogenous supplementation of Ca, K and Mg improved membrane stability in salt affected plants indicating the improvement oxidative stress tolerance. Alleviation of salt-induced osmotic stress by addition of Ca, K and Mg is understood by improved relative water content. Addition of these exogenous protectants in salt treated rice plants improved the SPAD value (chlorophyll content) and leaf area. The improvement of physiological attributes in Ca, K and Mg added salt affected plants resulted in improved growth, development and reproductive parameters which contributed to improve

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the yield attributes and yield of rice plants under salt stress. It was noticed that higher dose of these protectants resulted better effects on the salt affected plants among different doses. So, use of exogenous supplemented Ca, K and Mg can be effective way to mitigate salt stress damage in rice plants.