PAK. J. SOIL SCI., VOL. 13 (1-4), 1997

EFFECT OF BRACKISH WATER HAVING DIFFERENT CA:MG RATIOS ON THE GROWTH AND CHEMICAL COMPOSITION OF WHEAT AND RICE

*R. Ahmad[1], A. Ghafoor**, M. Abbas** and N. Yasmin**

ABSTRACT

A pot culture study was conducted on a calcareous loamy clay saline-sodic soil (pH_s 8.4, EC_e 27 dS m^{-1}, SAR 141.4, gypsum requirement 2.0 me 100 g^{-1}). Ten kg soil was filled in each pot having leaching provision. Two levels of lime 4 (originally present) and 12 % were developed. Commercial H_2SO_4 @ 50 and 100 % of soil GR was applied. One set of treatments received water (EC 2 dS m^{-1}, SAR 12, RSC 3 $mmol_c$ L^{-1}) with Ca:Mg ratio of 1:1 and the other with 1:6. In the control, canal water was used for irrigation. Wheat variety Faisalabad 85 was sown and after harvesting it, rice KS 282 was transplanted in the same pots. Fertilizers of NPK were applied to both the crops at recommended rates. In wheat, tillers, plant height, TDM and grain yields were, in general, significantly higher in acid treatments (T_4, T_5, T_8, T_9) irrespective of the type of irrigation water. In wheat straw, Mg and Cl concentrations were not affected significantly, Ca was more with higher rate of acid (T_5, T_9) while Na was more with lime treatments (T_2, T_3, T_6, T_7). In wheat grain, Na and Ca concentrations were statistically affected by the treatments, Na being more with T_2, T_3, T_6, T_7 while Ca with T_2 and T_6. As the Mg in irrigation water increased, concentration of Mg and Cl in grain increased. Similar effects of treatments were observed regarding the straw and paddy yields and chemical composition of rice.

INTRODUCTION

Salt-affected soils in Pakistan occur over an area of 6.3 mha (Khan, 1993). There is shortage of canal water to produce crops on normal soils. Under these conditions, >40 maf ground water is being used for supplementing canal water for irrigation (NCA, 1987). Unfortunately, 75 % of this water is hazardous and its indiscriminate use is aggravating the salinity and sodicity problems. These waters have high EC and SAR along with Mg concentration >Ca (Ahmad and Chaudhry, 1988).

Mostly, the researchers have used good quality water along with Ca sources or Ca mobilizing agents, like H_2SO_4 or HCl for the reclamation of native saline-sodic soils which are generally calcareous. Little work has been done on the use of high Mg water with high EC and SAR for this purpose. This study was planned to see the effects of poor quality water with high Mg concentration for the reclamation of a saline-sodic soil receiving sulphuric acid or lime and on yield as well as chemical composition of wheat and rice crops. In the present paper, results about the growth and chemical composition of crops are presented.

MATERIALS AND METHODS

A bulk sample of a calcareous loamy clay, saline-sodic soil (pH_s 8.4, EC_e 27 dS m^{-1}, soluble Ca + Mg 11.5 $mmol_c$ L^{-1}, Na 339.13 $mmol_c$ L^{-1}, K 4.97 $mmol_c$ L^{-1}, HCO3 11.65 $mmol_c$ L^{-1}, SAR 141.4, exchangeable Na 2.61 $cmol_c$ kg^{-1}, EC 5.0 $cmol_c$ kg^{-1}, GR 2.0 $cmol_c$ kg^{-1}) was collected from a field near Madhuana drain along the Faisalabad-Satiana road. After sun drying and passing through a 2 mm sieve, 10 kg soil was filled in glazed pots with leaching provision. Two levels of lime, 4 % (originally present) and 12 % which was created by mixing powdered $CaCO_3$ with soil before filling the pots. Commercial sulphuric acid @ 50 and 100 % of soil gypsum requirement (SGR) by Schoonover's method was applied with canal water. Initially, eight liters of canal water were applied to all the pots as soaking irrigation without any leaching. Wheat cv. Faisalabad 85 was sown when the moisture in soil was nearly at field capacity. Nitrogen, P_2O_5 and K_2O @ 75, 25 and 25 mg kg^{-1} soil were applied as urea, single super-phosphate and potassium sulphate, respectively. All the P, K and half the dose of N was applied at sowing and remaining N was applied 15 days after germination.