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ESTIMATION OF SAR_{dw} FROM SAR_{iw} UNDER FIELD CONDITIONS

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ABSTRACT

In field experiments, rice and wheat crops in rotation were grown with brackish water from sump S1B9 on the Hafizabad (Coarse loamy, mixed, calcareous, hyperthermic, Ustalfic Haplargids) and Khurrianwala (Coarse loamy, mixed, calcareous, hyperthermic, Aquic Haplargids) soil series from 1993 to 1996. Six equations were evaluated using LF calculated from Cl_{iw}/Cl_{dw} ratio to predict SAR_{dw} from SAR_{iw} at 0-15 or 0-30 cm soil depths after rice 1995 and wheat 1995-96. The equations of Oster and Rhoades (1977), Bower et al. (1968) and Rhoades (1968) generally over-predicted the SAR for both the soils, seasons and soil depths. The model of Suarez (1981) under-predicted the SAR. Equation of Ayers and Westcot (1985) was found the best closely followed by that of Jurinack (1990). However, it appears necessary to generate field data and develop a model for estimating SAR_{dw} from SAR_{iw} more precisely under agro-climatic conditions of Pakistan.

INTRODUCTION

Like many other agriculturally important areas of the world, the most common ions in the drainage/irrigation waters of Pakistan are Na, Ca, Mg, K, Cl and SO_4. According to many reports (Malik *et al.*, 1984; Ahmad, 1993; Ghafoor *et al.*, 1993), about 50 % pumped ground waters in Pakistan and all the effluents from the tile drain project in the Faisalabad district are hazardous for irrigation because of high sodicity. In this tile drain project, 79 sumps have been constructed which are pumping annually about 5.48 thousand hectare-metre of that the SAR is an effective measure of the potential sodium hazards of a water that is in exchange equilibrium with a soil (Rhoades and Bernstein, 1971; Rhoades, 1972; Ayers and Westcot, 1985; Jurinack, 1990). Sodium in irrigation waters tends to promote soil dispersion and structural breakdown resulting in decreased water transmission through soils. Among the problems associated with high sodium in soil-water system are soil crusting, poor seedling emergence, reduced soil aeration, reduced water availability to crops, nutrient imbalances and weeds as well as mosquito control. Because of the severe nature of the agricultural problems associated with excess sodium in soils, several equations have been developed to estimate the degree to which irrigation waters will cause sodication of soils.

Most of these models use the SAR of irrigation water (SAR_{iw}) to predict the resulting SAR of soil solution (SAR_{dw}). These models predict the soil solution SAR differently for different calcareous alkaline arid lands. Equations 1 and 2 (as listed in Materials and Methods section) have often been observed to predict an SAR about double the experimentally determined values (Muhammed and Rauf, 1983). Equations 4 to 6 have been reported to estimate the SAR very close to the observed ones (Suarez, 1981; Jurinack, 1990). Model 3 has been found to be in between these two groups (Yasin, 1983). In this regard, six models to predict SAR_{dw} from SAR_{iw} during the growth of rice and wheat crops receiving brackish water for irrigation on the Hafizabad and Khurrianwala soil series have been