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Effect of different Na/Ca Ratios on Growth and Mineral Composition of Paddy (*Oryza sativa* Var. Dulas)

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The salt tolerance behaviour of a crop varies with growth stage of the crop, effective salinity near the root zone, physical condition and fertility of soil. It is not reasonable to conclude about salt tolerance of a crop from the effect of salt on germination because in plants which survive, the tolerance is further created with advanced stages of growth, certain species of crop respond to sodium, a constituent which is responsible in creating adverse effect of salinity. The influence of sodium on plant growth varies with plant species and presence of other cations, in the root medium, influence its absorption. Wadleigh and Bower (1950) attributed adverse effect of alkali soils, on plant growth in part due to the decreasing availability of calcium associated with increasing proportions of sodium into exchange complex of soils. Kapp (1947) observed that soil salinity at the time of planting rice resulted in decrease in yield. Del-Valle and Bobe (1947) found that salinity was most harmful at the earliest stage. Similar results were reported by Pearson and Bernstein (1959), Singh *et al.* (1970) and Maliwal and Paliwal (1971). An experiment was therefore, planned to study the effect of varying Na/Ca ratios on yield of paddy and its mineral compostion.

Green house experiment was conducted at the B.A. College of Agriculture, Anand to test the effect of varying Na/Ca ratios on growth and mineral composition of paddy in two different soils i.e. *kyari* and *goradu*. Their physico-chemical properties were, texture clayey and loamy sand, pH (1:2.5) 7.5 and 8.1, organic matter 0.60 and 0.40 per cent, total nitrogen 0.045 and 0.028 per cent, Exch. K. 0.67 and 0.40, Exch. Ca 21.00 and 6.00, Exch. Mg 1.33 and 0.86, Exch. Na 2.00 and 0.35 meq/100 g of soil and water holding capacity 24 and 18 per cent respectively.

The soils brought from the field were air dried and passed through 2 mm sieve. From this soil Ca saturated soil was prepared by replacing the other cations by treating the soils with N NH_4Cl of 3 and 7 pH value and lastly leaching the soil with 1 N $CaCl_2$ solution. Therafter, the diffrent Na/Ca ratios were introduced by adding different amount of sodium bicarbonate into Ca Soil. The amount of sodium bicarbonate added to obtain different Na/Ca ratios are given in Table 1. The experimental pots were 15 cm in diameter and 25 cm in length were covered inside with plastic papers so that water can not be leached out and the Na/Ca ratios were maintained. The water lost from each pot by evapotranspiration was made up everye day at evening by weighing each pot and adding requisite quantity of distilled water

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TABLE 1

Effect on yield (g/pot) and mineral content (%) of rice plants in *Kyari* and *Goradu* soils at different Na/Caratios.

Treatment	*$NaHCO_3$**	*Kyari*						*$NaHCO_3$**	*Goradu*					
	added	*Yield*	*N*	*K*	*Ca*	*Mg*	*Na*		*Yield*	*N*	*K*	*Ca*	*Mg*	*Na*
Control	0.00	3.128	3.500	2.370	0.365	0.680	0.440	0.00	2.443	2.933	1.768	0.243	0.495	0.305
Ca Soil	0.00	5.938	3.969	0.595	0.498	0.378	0.280	0.00	2.564	3.640	0.643	0.413	0.315	0.263
0.20 (Na: Ca)	50.40	1.485	3.409	1.820	0.335	0.288	0.645	35.70	2.810	3.164	1.355	0.313	0.273	0.338
0.27 (Na: Ca)	105.00	0.000	0.000	0.000	0.000	0.000	0.000	52.50	1.345	2.912	1.203	0.260	0.243	0.415
0.33 (Na: Ca)	157.92	0.000	0.000	0.000	0.000	0.000	0.000	68.30	0.471	2.597	1.120	0.225	0.203	0.490
C.41 (Na: Ca)	212.06	0.000	0.000	0.000	0.000	0.000	0.000	86.10	0.163	2.359	1.000	0.205	0.198	0.453
S.Em.±		0.216	0.020	0.066	0.008	0.004	0.013		0.090	0.083	0.037	0.020	0.013	0.049
C.D. @ 5%		1.129	0.113	0.392	0.042	0.021	0.813		0.136	1.987	0.218	0.113	0.065	0.287

*The amount of $NaHCO_3$ added in 5 kg of soil.

(the gain in plant weight was neglected) poured through a measuring cylinder from the sides of pot by rotating the pot so as to extend to about half way to the bottom of the pot. This prevented flooding at the surface of the soil.

It can be seen from the results presented in Table 1 that Na/Ca ratios beyond 0.20 was toxic for the establishment of paddy seedlings in *kyari* soil(i.e. no dry matter was observed in Na/Ca ratio 0.27) whreas in *goradu* soil, the establishment of the seedlings was not affected. Looking to the crop performance, increased Na/Ca ratios caused retardation in growth. In *kyari* soil, Ca saturated soil gave maximum yield of 5.938 g/pot of dry matter while in *goradu* soil though camparatively less yield was obtained, yet the highest yield of 2.810 g/pot of dry matter was recorded at 0.20 Na/Ca ratio. In Ca-Soil, maximum nitrogen and calcium content in paddy straw in both *kyari* and *goradu* soil was obtained. In Ca saturated soil, the potassium, magnesium and sodium content of paddy decreased in both the soils as compared to the control. With establishment of various Na/Ca ratios in the same soil by treatments with sodium bicarbonate, there was decrease in nitrogen, potassium, calcium and magnesium contents as compared to the control in both the soils, while increase in sodium content was observed, at each level.

The results further revealed that increasing Na/Ca ratios, there was decrease in nitrogen, potassium, calcium and magnessium contents of paddy whereas, sodium content was increased. This may be account of direct effect of increase in sodium concentration in the exchange complex of soil. These results were in confirmation with Pearson and Bernstein (1958) and Bains and Fireman (1964). The effect may mainly be caused due to osmotic stress at relatively high level of nutrient and salt in the medium.

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