Agtic. Res. J. Kerala 1988, 26 (2) 290—292

PROPERTIES OF RED AND LATERITE SOILS WHEN SUBMERGED UNDER SALINE WATERS OF DIFFERENT CONCENTRATIONS

Red loams of Kerala are localized in occurrence and are found mostly in the southern part of Kerala, whereas laterites are typical weathering products of gneissic and granitic rocks, developed under humid tropical conditions. These soils are having optimum levels of physical conditions for better production of crops or plantations. Since the sea water is available to irrigate coconut plantations partially in summer season on red and laterite soils (which are very close to sea shore) a study is useful to evaluate the changes on the physical properties of these soils duo to saline water irrigation.

The experiment was conducted using red loam from Vellayani and laterite from Varkala. The soils (1.5 kg) passed through 2 mm sieve were taken in plastic containers of size 10 cm diameter and height 15cm. The red soil contained 42% coarse sand, 26% fine sand, 18.2% silt and 13.8% clay whereas laterite soil contained 31.2% coarse sand, 29.5% fine sand, 16.6% silt and 22.7% clay. The organic carbon of the red and laterite soils was 0.82% and 1.49% respectively.

The soils in the containers were kept submerged under waters having different salinity levels for a period of one month. The waters used were distilled water (T1) i. *e., zero* salinity, 25% sea water+75% distilled water (T2), 50% sea water+50% distilled water (T3), 75% sea water+25% distilled water (T4) and sea water alone (T5).

The contents of Na, K, Ca, Mg, chloride, biocarbonate and sulphate in the sea water were estimated using standard analytical procedures. The conception of the sea water used was sodium 10590 ppm, magnesium 1280 ppm, calcium 412 ppm potassium 358 ppm, chloride 19343 ppm, bicarbonate 150 ppm and sulphate 2690 ppm.

The experiment was laid out in completely randomized design (CRD) with three replications (Panse and Sukhatme, 1978). At the end of one month period, the water was drained off from the containers, the soils were air driad and analysed for their physical characteristics.

Bulk density, saturated hydraulic conductivity and aggregate stability of the soils were estimated by taking core samples and undisturbed soils (Dakshinamurti and Gupta, 1963). The specific gravity and maximum water holding capacity and volume expansion were estimated by the methods followed in Black (1965) and Wright (1934) respectively. Moisture retention, at 1/3 bar tension and 15 bars tension was determined by the pressure plate and pressure membrane apparatus (Richards, 1954). The soil reaction was measured in a 1:2.5 soil-water suspension using a pH meter. The electrical conductivity was determined in a 1:2 soil-water suspension using a solu bridge.

The influences of saline water treatments on pH, EC, bulk density and total porosity of the soils are given in Table 1. The acidity of red loam soil was higher than that of laterite soil. The highest pH was observed in the case of treatment T5. The EC of the soils increased with the increase in salinity levels of the treatments. The salinity was not found to have any effect on the bulk density, total porosity, volume expansion and maximum water holding capacity. Similar results were observed by Paliwal (1972) who found that the harmful effects due to the presence of excess salts were less on light textured soils than on heavy ones.

The effect of saline water treatments on moisture retention at different tensions and available water of the soils are given in Table 1. In all the treatments with different salinity levels the laterite soil showed higher moisture retention than the red loam soil. Moisture retention was maximum for the treatment To (sea water alone) which was higher than that of the T4, T3, T2 and T1 treatments. But the treatment T4 was higher than the T3, T2 and T1 treatments. Moisture retention values in T1 and T2 treatments were on par but these were lower than the moisture retention for the treatment T3.

The laterite soil showed higher moisture retention than red loam soil. There was a steady decrease in moisture retention as the salinity level decreased and it was minimum for the distilled water treatment. The interaction effect between soil group and water quality was of the same trend for the laterite and red loam soils. However, ths effects of the treatments T1 and T2 ware on par for the red loam soil.

Hence it is clear that water retained at 1/3 and 15 bar tensions increased with increase in the S3linity levels in red and laterite soils. This is obviously due to the effect of the sodium and magnesium ions in retaining more water. The maximum water holding capacity, however, showed the reverse trend of decreasing with increasing levels of salinity. Mohammed *et al.* (1962) noted that the water holding capacity decreased with the salt content. The highest available water was found in the case of distilled water treatment in both the soils and lowest was noted in the case of T5 treatment.

The hydraulic conductivity was affected by salinity levels (Table 1). The property decreased as the levels of salinity increased. The hydraulic conductivity was highest in distilled water treatment and lowest in sea water alone treatment (Iyer, 1957; Singh, 1972; and Dixit and Lal, 1972). The obvious conclusion is that the sodium and magnesium ions present in saline water tend to disperse the clay and resist the easy passage of water. The hydraulic conductivity of the red loam soil was significantly higher than that of the laterite soil.

Aggregate stability was also influenced adversely by the saline water treatments. As the salinity increased the stability of the aggregates decreased (Boldyrev *et al.* 1977). This again is to be attributed to the sodium and magnesium ions which bring about the deflocculation of the secondary particles in the soil.

Table 1

Effect of different concentrations of saline water treatments on the soil properties of red and laterite soils

Soil property	Treatments									
	Red soil					Laterite soil				
	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
pH (1:2.5)	5.54	5.54	5.65	5.95	6.11	5.79	5.77	5.86	6.12	6.31
EC (1:2.5) mmho/cm)	0.10	4.40	8.00	11.80	13.30	0.12	3.96	7.90	11.12	13.25
Bulk density (g/cm^3)	1.41	1.42	1.42	1.42	1 21	1.22	1.22	1.22	1.22	1.22
Total porosity (%)	45.35	45.09	44.96	44.96	44.96	56.94	56.70	56.59	56.58	56.58
Moisture retention at 1/3 bar tension (% on wt. basis)	10.20	10.33	10.72	11.15	11.70	17.63	17.92	18.37	19.03	20.06
Moisture retention at 15 bar tension (% on wt. basis)	5.34	5.70	6.40	6.90	7.86	10.13	10.61	11.36	12.38	13.77
Available water (%)	4.86	4.64	4.32	4.26	3.84	7.50	7.31	7.01	6.65	6.29
Maximum water holding capacity (%)	33.63	33.35	33.07	32.71	32.65	48.40	47.77	47.61	47.27	47.22
Hydraulic conductivity (cm/h)	45.27	37.17	28.51	16.03	10.53	23.01	18.12	12.22	5.79	22.95
Aggregate stability (%)	44.00	40.08	33.46	22.58	18.85	38.29	34.83	30.91	22.42	16.01

In the statistical analysis no significant difference was observed due to saline water treatments on the bulk density, total porosity, volume expansion on wetting and maximum water holding capacity, in both the soils. The water retained by red and laterite soils at tensions of 1/3 and 15 bars increased with increase in salinity levels. The increase in salinity resulted in significant reduction in hydraulic conductivity. The aggregate stability was also affected adversely by the salinity levels.

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