under irrigated condition (Table - 2). Besides high pod and grain yield, the protein content of seed was 25.9 per cent. It also shows an extreme tolerance to the drought and highly suited for all cropping system.

The morphological description of SBS 1 are; Habit - bushy and erect, plant height - 73 cm, pigmentation (stem) - green, mean No.of branches - 4-5, leaves-trifoliate, inflorescence-axillary receme, flower colour-light purple, pods long, flat and green, pod length-28.5 cm, pod breadth-2.6 cm, seeds per pod-12.6, 100-seed weight-131.6 g, days to 50% flowering-45-50 days, days to maturity-110-120 days.

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EFFECT OF SOIL STRUCTURAL INDICES AND DISPERSION COEFFICIENT ON SATURATED HYDRAULIC CONDUCTIVITY

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ABSTRACT

Soils from two major subgroups *viz.*, Typic Chromusterts and Typic haplustalf were evaluated for establishing the relationship between soil structural indices such as Percentage Aggregate Stability (AS), Structural Coefficient (SC), Mean Weight Diameter (MWD) and Dispersion Coefficient of Silt + Clay (DCSC) and clay alone (DCC) with saturated hydraulic conductivity. AS and SC were observed to influence Ks directly, MWD which is a measure of the stable pore geometry also directly influenced Ks. DCSC and DCC were significantly negatively correlated with Ks, perhaps influenced by ESP and SAR.

Hydraulic conductivity has a positive and highly significant correlation with soil aggregates greater than 0.25 mm and with mean weight diameter (Khanna *et al.*, 1975). Sandhu and Bhumbla (1968) recorded better correlation of aggregates with dispersion coefficient of clay than with clay and silt, suggesting the dominant role in the formation of stable aggregation. These soil structural indices are observed to vary in their effectiveness of influence on the saturated hydraulic conductivity. In the present study it was taken up to evaluate the effective involvement of some soil structural indices in shaping the hydraulic conductivity of soils under various conditions.

MATERIALS AND METHODS

Representative soil samples numbering 15 from horizons of four soil profiles belonging to soil subgroup, Typic Chromustert (Tcsc) and 12 from horizons of three soils profiles belonging to soil subgroup, Typic Haplustalf (Thsf) were collected in Kamarajar district of Tamil Nadu. Standard analytical methods described by Dakshinamoorthy and Gupta (1968) were employed to estimate the dispersion coefficient of silt and clay and clay alone, per cent aggregate stability (Structural Coefficient), Mean Weight Diameter. Soil reaction was determined using glass electrode and Electrical Conductivity was determined in the 1:2 soil water suspension using conductivity bridge (Piper, 1966). Organic carbon was estimated by the wet digestion method of Walkley and Black (1934). Saturated hydraulic conductivity (Ks) was estimated in the core samples (7.5 cm dia x 7.5 cm height) following the method described by Dakshinamoorthy and Gupta (1968).

RESULTS AND DISCUSSION

The structural indices along with the relevent soil physical properties of the subgroups are given in Table 1. The percentage of aggregate stability (AS) ranged from 40.01 to 90.68 and 29.9 to 70.7 with an average ranging from 51.0 to 73.2 and 45.0 to 58.9 in the pedons of the subgroups, Typic Chromustert (Tcsc) and Typic Haplustalf (Thsf) respectively. As the percentage of aggregates greater than 0.25 mm increased, the saturated hydraulic conductivity (Ks) was observed to increase in the soil, because the stability of aggregates helped in the formation of stable pore geometry which in turn aided the conduction of water. There was a significant positive correlation

Table 1. Physico-chemical properties of soil horizons.

P.No.	Horizon	Depth	Structural indices			Dispersion coefficient		Ks (cm/hr)	Org.C. %	ESP	pH	EC
			AS	SC	MWD	Silt + Clay	Clay					
1	2	3	4	5	6	7	8	9	10	11	12	13
I.	Subgroup : Typic Chromustert (Tcsc)											
	Profile No.1. R.R.S. Aruppukottai											
1.	Ap	0 - 20	79.2	0.81	3.76	1.85	0.01	0.78	0.37	5.2	8.4	0.50
2.	A12	20 - 50	89.4	0.75	1.57	2.43	0.02	0.39	0.28	5.5	8.4	0.80
3.	A13	50 - 75	64.5	0.57	1.23	1.20	0.03	0.45	0.16	5.2	8.5	0.80
4.	C1	75 - 140	59.8	0.79	0.50	7.68	1.28	0.02	0.14	10.7	8.8	1.12
	Profile No.2. Ammapatti											
5.	Ap	0 - 15	70.4	0.65	0.82	5.10	0.03	0.60	0.69	13.8	8.5	1.31
6.	A12	15 - 40	90.7	0.86	0.91	1.71	0.06	0.13	0.45	17.6	8.6	1.64
7.	A13	40 - 90	57.1	0.49	0.78	3.53	0.05	0.18	0.28	10.0	8.7	1.82
8.	C1	90 - 135	48.3	0.78	1.43	12.64	2.44	0.01	0.20	17.9	8.9	1.95
	Profile No.3. Vadugarpatti											
9.	Ap	0 - 15	64.9	0.34	0.65	2.40	0.02	0.56	0.43	14.8	8.5	1.22
10.	A12	15 - 60	48.0	0.76	0.78	2.78	0.04	0.27	0.38	17.5	8.6	1.86
11.	A13	60 - 180	40.0	0.78	0.76	20.34	4.68	0.01	0.29	24.8	9.0	2.23
	Profile No.4. Kumaralingapuram											
12.	Ap	0 - 20	68.2	0.48	0.88	0.30	0.03	0.17	0.55	18.2	8.6	1.31
13.	A12	20 - 45	56.4	0.56	1.23	6.63	0.03	0.12	0.39	19.4	8.6	1.72
14.	A13	45 - 90	41.7	0.75	0.64	3.12	0.07	0.22	0.32	16.6	8.5	1.86
15.	C1	90 - 180	45.0	0.82	1.35	7.19	1.23	0.01	0.18	19.0	8.8	2.40
II.	Subgroup : Typic Haplustalf (Thsf)											
	Profile No.5. Nedungulam											
16.	Ap	0 - 18	60.7	0.43	3.22	1.85	0.01	0.93	0.48	9.8	7.9	1.30
17.	A12	18 - 40	57.2	0.62	0.49	1.22	0.01	0.61	0.29	9.0	8.0	1.50
18.	B21	40 - 85	29.9	0.50	1.20	2.50	1.15	0.13	0.20	10.2	8.0	1.80
19.	B22t	85 - 150	32.1	0.89	1.32	0.12	0.05	0.10	0.11	13.0	8.0	1.40
	Profile No.6. Thambipatti											
20.	Ap	0 - 15	60.1	0.35	0.63	5.95	0.02	0.85	0.56	26.8	8.9	1.80
21.	B21	15 - 35	65.4	0.50	1.75	13.75	7.25	0.48	0.28	29.6	9.1	2.20
22.	B22t	35 - 90	60.0	0.27	2.02	20.23	12.41	0.17	0.19	32.1	9.1	3.00
23.	B23	90 - 145	50.2	0.87	3.11	17.62	10.13	0.01	0.12	31.5	9.2	2.90
	Profile No.7. Pudupatti											
24.	Ap	0 - 16	70.7	0.83	0.95	11.26	5.52	0.87	0.60	26.2	9.0	1.30
25.	B21	16 - 48	50.6	0.56	1.44	10.83	4.97	0.25	0.31	22.1	9.2	2.50
26.	B22t	48 - 80	0.49	0.49	0.78	14.82	9.95	0.12	0.19	22.6	9.2	2.70
27.	B23	80 - 150	0.99	0.99	1.45	24.76	15.30	0.01	0.13	33.2	9.2	2.30

between AS and Ks (r = 0.514** in Tcsc and r = 0.706** in Thsf) (Table 2). Similar results were reported by Bhatia and Srivastava (1982). There was a significantly positive correlation between Ks and organic carbon (OC) (r = 0.456* in Tcsc and r = 0.638** in Thsf). This was supported by a significant negative correlation between AS and Dispersion Coefficient of Silt and Clay (r = 0.574**) and dispersion coefficient of clay alone (r = -0.523**) in Tcsc.

The structural coefficient varied from 0.34 to 0.86 and 0.27 to 0.99 with the mean varying from 0.63 to 0.73 and 0.50 to 0.72 in the subgroup Tcsc and Thsf respectively. There was negative correlation between structural coefficient (SC) and Ks in both the soil series.

Table 2. **Some important correlations among parameters.**

	SC	MWD	DCSC	DCC	ESP	Ks
a)Typic Chromusterts						
Percentage Aggregate Stability (AS)	-0.016	0.357	-0.574**	-0.523**	-0.568**	0.511**
Structural Coefficient (SC)	..	0.287	0.327	0.358	0.090	-0.272
Mean Weight Diameter (MWD)		..	-0.154	-0.125	-0.464*	0.517**
Dispersion Coefficient of Silt + Clay (DCSC)			..	0.958**	0.568**	-0.535**
Dispersion Coefficient of Clay (DCC)				..	0.532**	-0.535**
Ex.Sodium percentage (ESP)					..	-0.631**
b)Typic Haplustalf						
Percentage Aggregate Stability (AS)	-0.333	-0.723**	0.180	0.236	0.344	0.706**
Structural Coefficient (SC)	..	0.403	0.186	0.369	0.122	-0.333
Mean Weight Diameter (MWD)		..	-0.429	-0.333	-0.425	-0.459*
Dispersion Coefficient of Silt + Clay (DCSC)			..	0.851**	0.896**	-0.461
Dispersion Coefficient of Clay (DCC)				..	0.811**	-0.389
Ex.Sodium percentage (ESP)					..	-0.252

*Significant at 5% level **Significant at 1% level

The mean weight diameter (MWD) ranged from 0.50 to 3.76 and from 0.49 to 3.22 with the mean value ranging from 0.73 to 1.77 and 1.66 to 1.88 in the soil subgroups Tcsc and Thsf respectively. The MWD, which is a statistical index of aggregation showed a significant positive correlation with saturated hydraulic conductivity of r = 0.517** and r = 0.459* in the soil subgroups Tcsc and Thsf respectively. This stable pore geometry as indicated by MWD facilitated steady conductivity of water through the soil.

Either silt plus clay or clay dispersion co-efficient was reported to be due to deflocculation of individual particles, might have been brought about by the dispersing agents such as sodium salt as evidenced by a significant positive correlation between the dispersion coefficient of silt + clay (DCSC) or clay alone (DCC) and the exchangeable sodium percentage (ESP) or the sodium adsorption ration (SAR). The correlation coefficient 'r' values are furnished in Table 2. The correlation coefficient of silt plus clay dispersion coefficient with ESP was better than with clay alone. Further ESP and SAR influenced the disperison coefficient positively and significantly in both the subgroups, thus it could be inferred that sodium salt through its dispersion process indirectly reduced the Ks. In fact, there was a significant negative correlation between DCSC and AS (r = -0.574**) in TCSC subgroup; and r = -0.480* in Thsf subgroup). In the present investigation there was a significant negative correlation between DCSC and Ks (r = -0.540* in Tcsc; and r = -0.593* in Thsf). The dispersion coefficient of clay (DCC) was negatively and significantly related in subgroups Tcsc (r = -0.541*) and Thsf (r = -0.579*). Gupta and Narain (1971) also obtained similar results.

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