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An Investigation of the Bulk Density Distribution of Alfisol and Entisol Profiles of Tamil Nadu*

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Bulk density distribution of Alfisol and Entisol profiles representing Vannappatti series, Tulukkanur series, Salem series and alluvium were studied. The (Entisol) Vannappatti and (Alfisol) Tulukkanur series recorded high bulk density (1.78 gm/cm^3) in the lower horizons. The significanec of aggregates and primary particles in increasing the bulk density is discussed.

The physical conditions of soil are important in influencing the fertility status in turn crop growth and the productivity. Bulk density is an important physical property which influences the infiltration rate, permeability, aeration and plant and root growth. The bulk density also directly influences the total pore space and gives a good estimate of the porosity of soil.

MATERIAL AND METHODS

Forty eight soil samples from the different horizons of the sixteen profiles of the typical soil series of alfisol (red) and entisol (Alluvial) soils were collected and used for the present investigation.

The weights of the core soil samples collected in metal containers of knwon volume were determined and the soils were ovendried at 105°C and the weights were again recorded. From the data the bulk density values were calculated (Dakshinamoorthy and Gupta 1968).

RESULTS AND DISCUSSION

The bulk density increased with depth in Alfisol (red soil) profiles. This is because of the natural compaction that is taking place in the geological time, as these are *in situ* formed soils The compaction could also have taken place due to passing of tools, implements, man and animals thereby causing the formation of dense layers at lower levels of the profile. Binding action of the sesquioxides which are rich in these soils could have also favoured natural compaction. The bulk density of Alfisol (red soil) ranged from 1.36 to 1.78 g/cm^3, with a mean of 1.54 g/cm^3.

In the case of Entisol (Alluvial) profiles in general, there was increase in bulk density from the surface to the second layer but with further increase in depth, the bulk density values decreased. This is due to the fact that these layers of soil have been transported and deposited during the flood causing the alternate deposits of sand and silt. This

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is evident in the mechanical analysis data wherein it was seen that in the surface layer, the sand content was higher than in the second layer which showed high values of silt contents. The bulk density varied from1.31 to 1.68 g/cm^3 and the mean value being 1.64 g/cm^3 in Entisol (Alluvial) profiles (Table 1).

The aggregation index and mean weight diameter were significantly related to the bulk density values (Table 2). When the soil is ploughed, worked, trampled by animals or run over by trucks and tractors, or if it is exposed to the action of beating rains it tend to loose aggregate structure on the surface Hence, the aggregation index was low in the surface in turn the bulk density was reduced at the surface compared to that of the sub soil layers. Positive relationship ($r=0.411^{**}$) obtained between bulk density and aggregation index is indicative of this phenomenon (Table 2).

The infiltration rate was significantly influenced by the bulk density which was evident from the fact that the high bulk density layers of Alfisol of Tulukkanur series and Entisol of Vannapatti series recorded low infiltration rate. The infiltration rate was high in Alfisol of Salem series which recorded low bulk density values at the surface and sub soil layers. The entisols which have bulk density layers recorded lower infiltration rate. Owing to the fact that the illuviation of sand and silt particles to the immediate horizons below the surface of the Salem series, they showed higher infiltration rate than the rest (Table 1) which is a measure of the permeability characteristics of the surface horizon

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Table 1. Bulk Density Distribution of Alfisol and Entisol Profiles and other Related Properties

Name of the soil series Profile No. and loation	Depth (cm)	Infiltration rate (cm/hr)	Bulk density (g/cm³)	Aggregation index (%)
Vannappatti Series (Vpt) Non-calcareous red soil (Entisol)				
I. Keranampatti	0-20	—	1.51	0.130
	20-40	—	1.75	1.664
II. Puliyampatti	0-18	—	1.51	0.421
	18-38		1.69	1.610
III. Mechery	0-10	5.60	1.42	0.268
	10-25		1.63	0.268
IV. Nangavalli	25-50		1.75	1.504
	0-19		1.42	0.410
	19-30	5.85	1.44	0.367
	30-52		1.47	1.676
Salem (Sim) Non-calcareous red soil (Alfisol)				
I. Anupur	0-9	6.35	1.52	0.301
II. Tukkuyampalayam	9-17		1.49	0.292
	0-12	—	1.41	3.189
	12-33		1.46	0.682
	33-51		1.47	0.367
III. Karipatti	0-6		1.49	0.250
	6-24	6.33	1.46	0.210
	24-35		1.49	0.350
IV. Alagapuram	0-34	—	1.37	0.376
	34-55		1.45	0.250
	55-61		1.44	0.238
Tulukkanur (Tlk) calcareous red soil (Alfisol)				
I. Idappadi	0-15		1.40	0.595
	15-40	5.67	1.61	0.415
	40-65		1.70	0.561

(Continued)

TABLE 1 (Contd...)

1	2	3	4	5	6
	II. Omalur	0-16		1.64	0.640
		16-30	4.86	1.73	0.867
	III. Bhuminaickenpatti	0-17	–	1.78	0 781
		17-34		1.66	1 076
		34-58		1.78	1.242
	IV. Kapilamalai	0-12	–	1.59	0.270
		12-23		1.54	0.500
4.	*Alluvium (A1) Calcareous alluvial soil* (Entisol)				
	I. Upparapatti	0-18		1.62	0.230
		18-65	5.00	1.69	0.353
		65-100		1 46	0.423
	II. Peramathi	0-9		1.39	0.528
		9-47	5.40	1.68	1.150
		47-78		1.32	0.724
		78-99		1.42	0.000
		99-132		1.42	0.208
	III. Mohanur	0-8	–	1.42	0.136
		8-40		1.42	0.170
		40-65		1.50	0 180
		65-92		1.42	0 200
		92-120		1.57	0.200
	IV. Pulampatti	0-14	–	1 32	0.223
		14-31		1.42	0.353
		31-63		1.31	0.535
		63-72		1.42	1.932

Table 2. Relationship of the Bulk Density (X) With Other Soil Properties (Y) in Alfisol and Entisol Soils

Properties (Y)	Correlation coefficient 'r'	Regression equation
Mean weight diameter	0.337*	Y=1.463+0.041 X
Aggregation Index	0.411**	Y=1.452+0.105 X