EFFECT OF ORGANIC MATTER ON SOIL AGGREGATION

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Soil aggregates are naturally occurring groups of soil particles in which the forces holding the particle together are stronger than the natural forces attempting its disruption. Soil structure is built up by the soil aggregates on granules those are formed by bonding of the individual soil particles. Out of the various methods of measurement of structure, amount of water stable aggregates is an important index.

It is known that organic matter improve the soil physical condition and its effect is commonly associated with increase in soil aggregation (Verma and Singh, 1974). A better aggregate status of soils improved the physical environment by way of improving air-water relationship and related properties which in turn will influence plant growth. This paper reports on an investigation carried out to find out the magnitude of effect of different sources of organic matter in some inceptisols of Assam.

An experiment using six different organic amendments viz. Compost, Vermicompost, Pressmud, Biogas waste, Mukta (commercial preparation) and Chopped straw was conducted on soil belonging to inceptisols of Assam. Bulk soil samples from 0-15cm soil depth were collected from twelve different locations and treated @10t/ha with these six amendment and incubated for ninety days by maintaining the moisture content of the samples at about 60% field capacity and at room temperature. The soil samples were analyzed for mechanical composition using international pipette method. And for water stable aggregates, soil samples were air dried at room temperature and during this process of drying, natural clods were broken with gentle pressure through 8mm mesh sieve and retained in 5mm sieve. Fifty grams of soils retained in 5mm mesh sieve were kept in humidity chamber (at 95% RH) for 24 hours and then transferred to the topmost sieve of nest of sieves arranged in the order of 5mm, 2mm, 1mm, 0.5mm, 0.25mm and 0.1mm. The sieves were then immersed under water for 30 minutes and shaken in Yoder's apparatus. Each of the fraction retained in each sieve was collected oven dried, weighted and percent aggregate of various sizes was calculated. Mean weight diameter was then calculated from the equation given by Van-Bavel(1949).

$$MWD = \sum_{l=1}^{n} Xidi$$

where, Xi is the proportion by weight of a given size fraction and di is the mean diameter of each size fraction in mm. Thus, single value constant was expressed in mm.

The pertinent characteristics of the soils are presented in Table 1. Soils in general are medium to light textured. The soils of flood-affected areas are lighter in texture as compared to flood free situations. Soils of highland including Tea garden had more or less equal proportion of sand and silt. The soils being medium to light textured, the bulk density were found to be towards the higher side. In general, bulk density of flood affected areas were higher than flood free situation due to more disturbance of flooding.

In the size range of 8-5mm of aggregate, application of amendments did not show significant difference between the amendments (Table 2). But Biogas waste (13.09%) showed a better aggregating ability in this size range. In the size range of 5-2mm all showed a significant effect on aggregation. Mukta (9.03%)

and Vermicompost (8.29%) helped the soil in the aggregation of this size range. Also, in the size range of 2-1mm along with this two organic sources Compost also showed better aggregating ability. Remarkably, in the size range of 1-0.5mm none of the organic sources were found to differ significantly in their role on aggregation. But in the lower size range it was chopped straw which surpassed all other sources in aggregating the soil.

It was observed that out of six sources of amendments Chopped straw followed by Pressmud produced significantly higher aggregation in the smaller sized range. While in the larger sized fraction Compost followed by Mukta was responsible for higher aggregation. The time allowed may have been too short for the Chopped straw to decompose in order to effect aggregation in the larger size range. Similar result were earlier reported by Raman et. al. (1996) and Sing et. al (1996). A strong influence of Chopped straw on aggregation in the smaller sized range is strange considering the fact that these were totally un-decomposed material. But the increase in the size range may be because of contribution of smaller fragments of the straw that have behaved like small sized aggregates. Pressmud is known for higher concentration of Ca and Mg which bind individual soil particles to form aggregate in the smaller size range (Patgiri, 1985; Barkakoty, 1990). Also in the larger sized range physical forces are more active in contributing smaller aggregates into larger ones. Hence, compost and Mukta, which are rich in semi decomposed organic components, have acted significantly in these size ranges of aggregates in the soil.

Mean weight diameter being one of the indices of soil aggregation showed that Chopped straw (0.52) was better in aggregation (Table 2). But increase in the size range of the smaller fraction due to un-decomposed fragments of Chopped straw has made the effect of Chopped straw contradictory. Pressmud and Bigas waste also showed good result. However, effect of Compost (0.18) was least among all the sources. Of the six different organic sources, compost was the most decomposed and thus, it may be effective in aggregating the soil in the long run through its various binding effects (Patgiri, 1985; Haris et. Al., 1996) which in the present investigation was not manifested due to short span of time allowed.

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Table 1. (Mechanical composition, pH and bulk density of the soils of different agro-ecological situations)

Soil used	Sand (%)	Silt (%)	Clay (%)	Textural Class	P^H	Bulk density ($Mg\ m^3$)
Humid alluvial flood free (Sibsagar)	47.5	10.0	42.5	SC	5.2	1.41
Humid alluvial flood free(Titabor)	54.0	30.5	15.5	SL	5.5	1.53
Sub-humid alluvial flood free (Titabor)	35.7	53.8	10.5	SiL	5.2	1.48
Sub-humid alluvial flood free (Golaghat)	45.0	32.5	22.5	L	4.7	1.26
Humid alluvial flood prone (Jorhat)	34.3	52.5	13.2	SiL	5.9	1.68
Humid alluvial flood prone (Sibsagar)	45.8	11.0	43.2	SC	4.7	1.32
Highland (Titabor)	46.0	44.5	9.5	L	5.1	1.44
Highland (Golaghat)	55.0	25.0	20.0	SL	4.5	1.24
Hill area (Golaghat)	52.5	25.0	22.5	SCL	4.7	1.41
Hill area (Numligarh)	82.5	2.5	15.0	LS	4.7	1.35
Tea garden area (Jorhat)	76.5	7.5	16.0	SL	4.3	1.22
Tea garden area (Titabor)	29.0	56.5	14.5	SiL	4.4	1.33

Textual Class; S = Sandy; C = Clay; Si = Silt; L = Loam.

Table 2. Effect of amendments of soil with organic sources on aggregation

Amendments	Aggregate (%) in size range (mm)						
	8.0-5.0	5.0-2.0	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	MWD (mm)
Compost	11.30	7.99	9.35	4.83	4.25	3.76	0.18
Vermicompost	12.43	8.29	9.06	4.63	5.50	6.06	0.30
Pressmud	11.40	6.31	6.96	4.34	7.74	8.88	0.44
Biogas waste	13.09	7.01	7.64	4.20	5.91	7.67	0.38
Mukta	11.62	9.03	6.79	4.50	4.58	4.61	0.23
Chopped straw	9.50	5.14	6.34	4.07	9.71	10.45	0.52
S.E. (±)	0.65	0.52	0.46	0.49	0.65	0.76	0.03
CD (P=0.05)	1.27	1.02	0.91	NS	1.27	1.49	0.07