Strength ratio and mineralogical characteristics of latosols in and around Thoothukudi

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Abstract

In order to minimize compaction and other degrading forms of agricultural land there is an increasing requirement for estimating the capacity of soils in support of load to a greater extent. We evaluated in this work, four varieties of latosol (oxisol) were used for the association between capacity support and soil mineralogy. Our results revealed that the color of the soil was the first to discriminate in the capability of load support in latosols. The load support capacities of hematic (flushed) latosols compared to Goethite (yellowish) soils were lower. We found that clay mineralogy is linked to the development of the soil structure and subsequently to the soil load supporting capability. Our work set the foundations for the extensive estimate of force characteristics in latosols shown by their very stable and simple crystallographic structure. Our results assist explain how soil structure linked with soil mineralogy is controlled by load support and compaction sensitivity in these extremely weathered thoothukudi soils.

Keywords: *Mineralogical, Strength ratio, Latosols, Thoothukudi, Soil*

1. Introduction

Soils are complex solid, liquid and gas assemblages, with a solid component representing around 50 percent. In generally, constitute the enduring partially. The component of the soil is composed of around 45 per cent (inorganic) and 5 per cent organic substances. The inorganic component is known for its size from clay (< 002mm) to the sand (2–0.05mm), both primary and secondary minerals. Minerals are natural inorganic, physically, chemically and crystallinely characterized components impacting the physical and chemical aspects of the individual soil types. Latosol is the most frequent form of soil with Thoothukudi, quartz, as well as other extremely resistant minerals, the high degree of weathering to which latosol are subjected is also reflecting the Depending on the parents, pedogénesis and environment the color of the Latosols varies from red to yellow. In Thoothukudi, the structure of latosols is mostly linked to the mineralogy of clay fraction research on seven latosol samples in the Thoothukudi state of Mina Gerais and Espı ̈rito Santo demonstrated the physical properties of the soil structure of the clay fraction had been considerably determined. Similarly, have identified certain connections between the strength of the intrinsic soil and the assembly of clay minerals. Minerals of brass have been collected. showed that the saturated hydraulic conductivity of latosol changes mostly in terms of the tone concentration and large pores, but has no direct link to terrestrial fractional mineralogy in the research from the Thoothukudi central plateau. Have also discovered that permeability rises with clay levels in seven types of latosols samples investigated. A recent understanding of the extent of the soil degradation due to the use of heavy machine and equipment and its economic and environmental. The connection of the preconsolidation pressure of the soil and water suction might be regarded as load-bearing capacity of soils. Pressure from pre-consolidation shows the highest presurability to be used in soil in order to prevent compaction with soil. It's a factor of soil. On the other hand, the water suction, effectively a control component, may be modified. Our objective in the study was to relate the strength of soil to a mineralogy of soil, using four latosol variations, associated with various parent materials and Brazil's environment.

2. Materials and methods

2.1 depiction of site methodology for case

The sites selected reflect different geographical regions, diverse environmental circumstances and growing approaches. At all locations using Uhland samplers, seven samples were collected in aluminum rings of 6.5 cm 2.5 cm in the B horizons. With a dropping weight, the sample instrument was gently poured into the ground. The tanks (1 m 2 m 1 m) have been carefully excavated to prevent soil layers from being compacted. In order to assure proper presentation, samples were gathered at random in each pit. The samples were taken at places between a depth of 80 and 100 cm. Because these soils are relatively morphologically homogenous, the samples are collected from "clean B horizon" to prevent the impact of organic matter on soil characteristics as far as feasible. Therefore our data may be extended from the top of the B horizon where likely traffic hazard can occur. Even certain sections of Thoothukudi have soils up to a depth of 90 cm, so that the roots of perennial plants like eucalyptus sp are distributed well and properly.

2.2. Characterization of physics, chemistry and mineralogy

The initial field density of each sample was determined using this method. The disturbed soil samples were dried in the air through a 2 mm filter and stored in plastic bags before further tests. Before further analysis, they were sprinkled. In Thoothukudi soil surveying, that approach reflects the composition of the clay fraction. This method is a conventional practice. Slides without orientation have been scanned with 0.0282usteps and 1 s counting times each step from 48to 5082u (free-iron clay) and 258to 4882u (iron concentration clay). Soil colors were evaluated visually in wet samples by comparison with the Munsell color chart.

2.3. Compressibility test

Every 7 samples, from the preparations of the ground cores, had been saturated with capillary and distilled water and had a balance of 2, 6, 10, 33, 100, 500 and 1500 kPa. The uninterrupted samples of the soil were tested using a pneumatic S-450. Each pressure was applied to 90% of the max. deformation and the pressures to the next level were raised. The maximum deformation was found by drawing a straight line along the data points of the original section of the curve acquired by drawing the dial readings vs the cuadrate of the times until the y-axis was intercepted in this line.A second straight line with the abscissa 1.15 times the width of the equivalent values on the first line was drawn from this junction. The intersection between this second line and the lab curve is the point of consolidation of 90%

Table 2 The latosols analyzed were physical and morphological features

Soil	Munsell color	Sand (g kg^1)	Silt (g kg^1)	Clay (g kg^1	Pd (kg m^3	Bd (kg m^3)
LAV	9.8R 4/8	155	170	700	2.97	1.72
UBJ	2.7YR 4/8	288	75	580	2.76	1.02
ESP	9.7YR 6/6	476	60	470	2.65	1.55
RGS	9.8R 5/6	87	120	820	2.50	1.25

2.4 Experiment

The data was employed to build soil compression curves which indicated pre-consolidation pressure (p) following the Dias Junior and Pierce approach Pre-consolidation pressure data were afterwards calculated against the potential for soil water and a regression line with a function in the regression line is the model with which the soils under examination are supported. It means the adjustment to fluctuating water matrix potential of the pre-consolidating pressure.

Table 3 **Containing oxides and other mineralogical components of samples of latosol**

	SiO2 (g kg1)	**Al 2O3 (g kg)**	**Fe 2O3 (g kg1**	**P 2O5 (g kg1)**	**TiO2 (g kg1)**	**Hm/(Hm + Gt**	**Gb/(Gb + Ka)**
LAV	155	270	208	0.35	22	0.58	0.44
UBJ	123	259	102	0.32	18	0.76	0.62
ESP	167	168	10	0.05	10	0.02	0.1
RGS	249	208	207	0.19	2.98	1.03	0.1

3. Results and discussion

3.1. Soil color

Table 2 presents the flag of the different soil samples obtained using the Soil Color Charts. Soil colours, which were widely employed in the categorization of Thoothukudi soils, are indications of the soil formation process. The hue of Munsell in the ESP sample indicated the prevalence of Goethite in the sample. Table 3 has the following indications for the ratios of hematite. The numerous latosols analyzed may thus be divided into two primary categories such as, hemenic or red soil consisting of Santo Angelo samples Lavras and Uberland and Goethite or Yellow samples consisting of Aracruz samples.

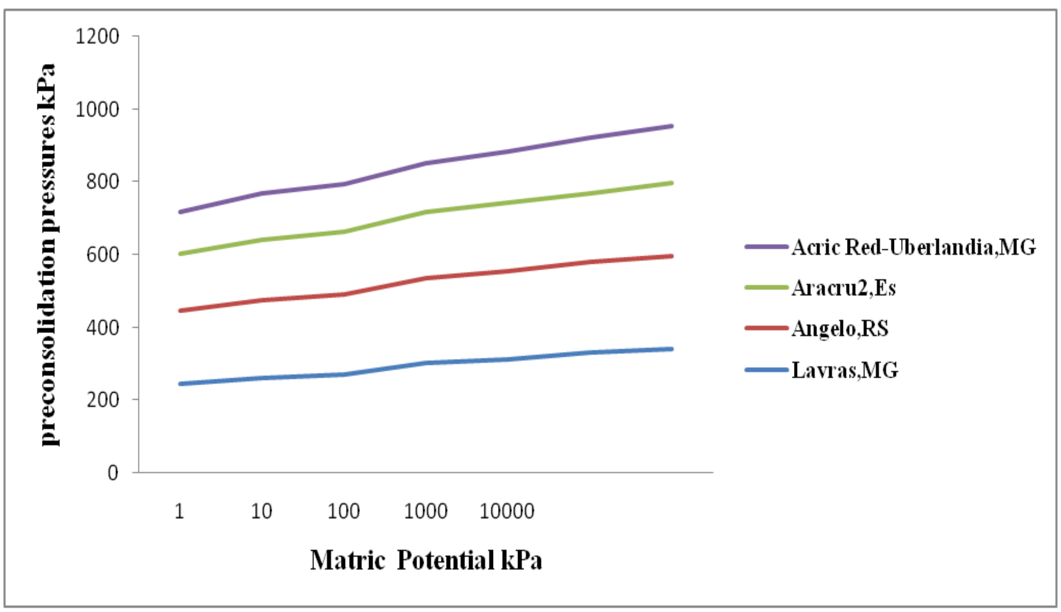

Fig. 1. latosol samples collected at all sites.

3.2. Comparison of models of load capacity

Fig. 1, with its determination coefficient and importance, shows the carrying capacity models of the different samples. The comparison of the model bearing capacity indicated that in all the samples, the soil strength changed with the water condition. The results of many soil strength investigations were consistent with the results The strength of soils improves at high water potential with small water potential changes. However, this relies on the soil structure and the solid content of the soil. Due to the strong pore water pressure generated in soil, soil strength is diminished at low water potential. This finding indicated that soil color may be utilized as a first tool for determining the strength of soil.

3.3 Mineralogy and soil strength

The cohesive aspect of this soil is a distinguishing feature of this soil type, which is readily seen in the field when it is a little dry The mineral assemblage of clay was dominated by koolin compounds, rich in iron Oxides but without gibbsites, in the Red Dystroferic latosol collected by Santo Angelo(RGS). This scenario is linked to the obstructive structure, which increases the bulk density and reduces soil porosity The increased load carrying capability of this soil can also be explained with the decreased water suctionThis structure is particularly sensitive to compactions at high water suction and leads to poor volume density. The soil therefore has a poorer ability to withstand load than the block structure of the face-to-face arrangement (RGS)

4. Conclusions

Our results have shown that earth colors may be employed as the primary discrimination against the capacity of load bearing in latosols. Low load support capability relative to goethytic land had been observed as hematic latosols. There are behavioral variations with their mineralogy among red soils. The load/support capacity of the soil reduces as the content of the gibbsite grows. We found the soil structure and hence the load support capability of the latopolys is connected with clay mineralogy. Our results assist explain how soil structure linked with soil mineralogy is controlled by load support and compaction sensitivity in these extremely weathered thoothukudi soils.

References

[1] Alakukku, L., Weisskopf, P., Chamen, W.C.T., Tijink, F.G.J., van der Linden, J.P., Pires, S., Sommer, C., Spoor, G., 2003. Prevention strategies for field traffic-induced subsoil compaction: a review. Part 1. Machine/soil interactions. Soil Till. Res. 73, 145—160

[2] Cavalieri, K.M.V., Arvidsson, J., da Silva, A.P., Keller, T., 2008. Determination of precompression stress from uniaxial compression tests. Soil Till. Res 98, 17—26

[3] Dias Junior, M.S., Leite, P.F., Lasmar Júnior, E., Araújo Junior, C.F., 2005. Traffic effects on the soil preconsolidation pressure due to eucalyptus harvest operations. Sci. Agric. (Piracicaba, Brazil) 62 (3), 248–255

[4] Flowers, M., Lal, R., 1998. Axle load and tillage effect on soil physical properties and soybean grain yield on a mollic ochraqualf in northwest Ohio. Soil Till. Res. 48, 21–35.

[5] Hamza, M.A., Anderson, W.K., 2005. Soil compaction in cropping systems: a review of the nature, causes and possible solutions. Soil Till. Res. 82, 121–145

[6] Gregory, A.S., Whalley, W.R., Watts, C.W., Bird, N.R.A., Hallett, P.D., Whitmore, A.P., 2006. Calculation of the compression index and precompression stress from soil compression test data. Soil Till. Res. 89, 45—57

[7] Marques, J.J., Schulze, D.G., Curi, N., Merttzman, S.A., 2004. Major element geo- chemistry and geomorphic relationships in Brazilian Cerrado soils. Geoderma 119, 179—195.

[8] Silva, A.V., Farias, M.F., Reatto, A., Martins, E.S., Brossard, M., Becquer, T., Oliveira, O.R., 2006. Caracterização e distribuição das principais classes pedológicas do Planalto Central Brasileiro. In: Anais do XXV Congresso Brasileiro de Ciência do Solo. SBCS, Recife-PE (CD-ROM)

[9] Oliveira, G.C., Dias Junior, M.S., Resk, D.V., Curi, N., 2003. Alterações estruturais ecomportamento compressivo de um Latossolo Vermelho distrófico argiloso sob diferentes sistemas de uso e manejo. Pesq. Agropec. Bras. 38, 291—299 (in Portuguese, with English abstract).

[10] Rücknagel, J., Hofmann, B., Paul, R., Christen, O., Hülsbergen, K.J., 2007. Estimating precompression stress of structured soils on the basis of aggregate density and dry bulk density. Soil Till. Res. 92, 213—220

[11] Silva, V.R., Reinert, D.J., Reichert, J.M., 2002. Fatores controladores da compressi-bilidade de Argissolo Vermelho-Amarelo distrófico arênico e de um Latossolo Vermelho distrófico típico. II Grau de saturação em água. R. Bras. Ci. Solo 26, 9—15 (in Portuguese, with English abstract)

[12] Veiga, M., Horn, R., Reinert, D.J., Reichert, M.J., 2007. Soil compressibility and penetrability of an oxisol from southern Brazil, as affected by long-term tillage systems. Soil Till. Res. 92, 104–113.

[13] West, S.L., White, G.N., Deng, Y., McInnes, K.J., Juo, A.S.R., Dixon, J.B., 2004. Kaolinite, halloysite and iron oxide influence on physical behavior of formulated soils. Soil Sci. Soc. Am. J. 68, 1452–1460.

[14] Veiga, M., Horn, R., Reinert, D.J., Reichert, M.J., 2007. Soil compressibility and penetrability of an Oxisol from southern Brazil, as affected by long-term tillage systems. Soil Till. Res. 92, 104—113.

[15] Vomocil, J.A., 1965. Porosity. In: Blake, C.A. (Ed.), Methods of Soil Analysis. American Society of Agronomy, Madison.

[16] Zhang, B.R., Horn, R., Baugmartl, T., 2001. Shear strength of surface soils as affected by soil bulk density and soil water. Soil Till. Res. 59, 97—106.