Extending the Soil Database of the Dry Zone of Sri Lanka to Cover the Northern Region

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Abstract

With the agricultural development in the Northern region of Sri Lanka, there is a need to characterize the soils for land use planning and environmental applications. The objective of this study was to characterize the soils in the Northern region of Sri Lanka to extend the soil data base of the Dry zone, specially the Calcic Red Latasols and Calcic Yellow Latasols, the two major soils occurring in the Jaffna district. These soils were identified, benchmark sites were selected and the landscape features were recorded with soil profile descriptions. Soil physical and chemical properties were studied in each horizon of the soil profile using standard procedures. The excessively drained Calcic Red Latasols occur in all areas other than then depressions of the Karst plains while the Calcic Yellow Latasols which are imperfectly drained occur in depressions of the land unit. The results reveled that Calcic Red latasols show a sandy loam texture while the Calcic Yellow latasols are slightly heavier showing a sandy clay loam texture. The soil eordibility factor of the Calcic Red Latasols and Calcic Yellow Latasols were 0.21 (medium risk) and 0.31 (high risk), respectively. Soil conservation measures to reduce erosion by water are needed for the latter. Both the soils show susceptibility to wind erosion and conservation practices such as mulching is recommended to overcome this problem during the dry periods. The saturated hydraulic conductivity of Calcic Red Latasols was very rapid showing the danger of leaching of inputs as fertilizers and pesticides to ground water easily.

Key words: Calcic Red latasols, Calcic Yellow Latasola, Jaffna

Introduction

The soil survey conducted by the Soil Science Society of Sri Lanka for the Dry Zone was limited only down to Madawachchiya in North Central Province (Mapa *et al.*, 2010) due to inaccessibility to the Northern region during that time. With the development of the Northern area, there is a need to extend the soil database to cover areas North of Madawachhiya. At present these areas are accessible and many new agricultural projects have been initiated without proper planning. As the Northern region was predominantly an agricultural area, information on its soil resource is needed for planning and management of agriculture in sustainable manner. Having a soil database will facilitate proper land use planning, soil series based fertilizer recommendations and environmental conservation in these areas. Therefore, a research project was initiated to study the morphology and to characterize, classify and map the soils of the Northern region of Sri Lanka. The objective of this paper was to present the results obtained for the two major soils, Clacic Red Latasols and Calcic Yellow Latasols occurring in the Jaffna District of Sri Lanka.

Materials and Methods

In this study, the Northern area of Sri Lanka to the north of Madawachchiya was considered. The major soil series of this area were identified based on topography, parent material, climate, vegetation and documented past information. A benchmark site showing average characteristics for each soil series were selected for further study. The characterization of the landscape and soil profile description was done according to FAO method (1999). Physical and chemical properties were measured for disturbed and soil core samples obtained from each horizon using three replicates. The soil physical properties measured include soil colour, texture using pipette method, bulk density by core sample method and saturated hydraulic conductivity

using constant head device method (Dane and Topp, 2002). The chemical parameters characterized were pH using a pH meter with a glass electrode, electrical conductivity (using an EC meter), and organic carbon using Walkley-black method (Sparks, 1999). These results, with combination of similar results obtained for many other soil series were used to extend the soil database for the Dry Zone of Sri Lanka to the Northern region.

Results and Discussion

Calcic Red Latasoils, Calcic Yellow Latasols, Solodized Solonetz, Red Latasols, Yellow Latsols, Grumusols, soils on recent marine calcareous sediments, soils on old alluvium, alluvial soils of variable drainage and texture, and Regosols on recent beach sands are the Great Soil Groups found in the Northern area of Sri Lanka. The major soils occurring in Jaffna district are Clacic Red Latasols and Calcic Yellow Latasols, which are described here as they have been not studied in detail in the past. When the distribution of these two Great Soil Groups in the landscape is considered, the Calcic Red Latasols occur in all areas of Karst plains other than the depressions. The Calcic Yellow Latasols occur on the slope bottoms and at dispersions of the land unit. Both these soils occur overlying limestone and show variable soil depths. Four genetic soil horizons were identified in each sol profile. The Calcic Red Latasols were excessively drained with dark red to dusky red colour with sandy loam textures and weak, fine, sub-angular blocky structure. The Calcic yellow Latasols were imperfectly drained yellowish brown coloured soils with sandy clay loam textures and moderate to strong, medium, sub-angular blocky structure. Some of the selected characteristics of Calcic Red Latasols and Calcic Yellow Latasols occurring in Jaffna district are shown in Table 1.

Table 1. Selected soil properties of major horizons in Calcic Red Latasols and Calcic Yellow Latasols occurring in Jaffna District.

Horizon	Depth (cm)	Clay (%)	Textural class	Bulk Density (Mg/m³)	Ks# (cm/h)	pH (1:2.5)	EC+ (mS/cm)	OC* (%)
Calcic Red Latasols								
A1	0 - 12	18.06	Sandy loam	1.66	33.17	5.40	0.046	1.24
AB	12 - 35	19.47	Sandy loam	1.61	----	5.15	0.042	1.13
B2	35 - 65	19.77	Sandy loam	1.70	35.04	5.73	0.032	0.13
B3	65 - 125	20.13	Loam	1.80	18.55	5.62	0.043	0.13
Calcic Yellow Latasols								
Ap	0 - 7/10	11.88	Sandy loam	1.80	2.47	7.28	0.104	1.82
B1t	7/10 - 30	20.50	Sandy Clay loam	1.71	--	7.31	0.081	1.26
B2t	30 - 85	26.68	Sandy Clay loam	1.65	--	7.62	0.082	0.33
BC	85 - 130	29.53	Sandy Clay loam	1.51	--	7.67	0.095	0.28

(#Ks= saturated hydraulic conductivity: +EC=Electrical conductivity; *OC = Organic carbon)

The data obtained for Calcic Red Latasols and Calcic Yellow Latasols were added in extending the soil database of the Dry zone of Sri Lanka to Northern region. The results showed that Calcic Red Latasols do not have any argillic horizon in the soil profile. Clacic Red Latasols showed sandy loam texture and very rapid saturated hydraulic conductivity (Ks). The Calcic Yellow Latasols showed argillic horizons at 7/10-30 cm and 30-85 cm depth increments, and the soil textural class was Sandy Clay Loam. As this soil showed higher clay contents, the saturated hydraulic conductivity was lower. The soil erodibility factor (K factor), estimated using soil erodibility monograph proposed by Wischmeier and Smith (1978), for Calcic Red Latasols and Calcic Yellow latasols were 0.21 and 0.31 respectively. This indicates the risk of water erosion in Calcic Red Latasols is medium, whereas that in Calcic Yellow Latrasols is high. This is due to the differences in many parameters as silt, very fine sand, sand, organic matter content, structure and permeability which are used to estimate the soil erodibility factor.. The soil erodibility factors documented for Sri Lankan soils range from 0.48 to 0.17. In managing Calcic Yellow Latsols, conservation measures in reducing erosion by water become important. Both these soils show susceptibility to wind erosion during the dry periods due to the sandy loam texture, and therefore, mulching using organic residues has to be practiced as a conservation measure. As the saturated hydraulic conductivity of Calcic Red Latasols is very rapid there is a risk of leaching of agricultural inputs, which can lead to pollution of groundwater easily. Therefore, agricultural inputs as fertilizers and pesticides should be applied cautiously. Both the soils did not show any limitations with relation to salinity, as documented for the other dry zone soils, while the organic matter content was low due to rapid decomposition.

It could be concluded that the two major soils occurring in Jaffna district, the Calcic Red latasols and Calcic Yellow Latasols showed sandy loam and sandy clay loam textures, respectively. The soil erodibility factor was medium in Calcic Red Latasols and in Calcic Yellow Latasols the erodibility factor was high and need to use soil conservation measures.. Both of these soils are susceptible to wind erosion and therefore mulching should be practiced during the dry season when soil is exposed. The saturated hydraulic conductivity of the Calcic Red Latasols was very rapid resulting in leaching of inputs to ground water, which will reduce the use efficiency of inputs and increase the environmental pollution.

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