

A method for classification of paddy soils of Ceylon

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INTRODUCTION

MODERN systems of soil survey based on soil profile characteristics that are of agronomic significance to highland crops cannot be directly applied to paddy soils which are maintained in a flooded condition and are hence different from highland soils. Therefore it is necessary to develop special systems of classification for paddy soils.

Though rice constitutes the staple diet of more than half the world's population systematic studies on paddy soils are of comparatively recent origin and are relatively scanty.

Much of the work reported on paddy soil classification comes from Japan. The first stage of paddy soil classification studies in Japan started in 1930 and the first recognised system was proposed in 1940 by Kamoshita. He considered only natural hydromorphic paddy soils and divided them into five categories namely: Bog soils, Half bog soils, Lowland wet soils, Grey lowland soils and Brown lowland soils (Kamoshita 1940).

In addition to natural hydromorphic soils, paddy soils formed under the influence of irrigation water were also included in the classification systems proposed during early post war years. Uchiyama (1949) in his classification system recognised four fundamental types of paddy soils, Blue reducing type, Grey bleached type, Grey brown intermediate type and Brown oxidic type. In another system of classification proposed by Kanno (1956), water was considered to be the most important genetic factor in the development of paddy soils.

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He classified paddy soils based on the observable morphological features such as gley formation, mottle formation and bleaching that result from differences in water regime in a soil.

Since 1960, many workers have proposed several systems of paddy soil classification. Yamasaki (1960) defined paddy soil formation as the process of formation of eluvial A horizon and illuvial B horizon from parent soil, and distinguished paddy soils formed under the influence of ground water from those formed by the effect of surface water. Kanno (1962), proposing a still more modern system classified paddy soils based on the differences in hydromorphism as expressed in gleying and mottling.

A system quite different from the pedogenetic systems discussed so far was proposed by Oyama (1962). In his morphogenetic system paddy soils were named by the most diagnostic horizon in the profile. Seven such horizons were recognised, and hence seven great soil groups. Although he divided these into families, omission of lower categories was a notable deficiency.

The Pedologists Association in Japan in 1963 accepted a classification system essentially based on Kanno's system. Further improvements to this system were effected by Matsui (1966) in his system of paddy soil classification which was based on the characteristics of the original soil, hydrologic conditions in soil and the resulting hydromorphic properties. He recognised paddy soils derived from high land soils, alluvial soils and from bog soils and subdivided them according to the water regime, the nature of organic matter, characteristics of the parent soil, surface soil texture and important agricultural characteristics.

In Ceylon, among the paddy soil survey studies reported could be mentioned the all island survey of the fertility characteristics of rice soils (Panabokke and Nagarajah 1964) and the survey of rice soils in Hewagam Korale and Hapitigam Korale (Thenabadu et al 1967, a. b.). However, there is little or no information on methods of classifying paddy soils in Ceylon. The present study is an attempt to developing a system, following the modern methods of paddy soil classification.

General principles underlying modern paddy soil surveys

Unlike in other soils, water plays the most dominant role in paddy soil formation and hence in modern paddy soil surveys water is considered the most important genetic factor (Kanno 1956).

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Paddy soils are normally submerged and are subjected to cultivation under this condition. This brings about certain unique changes in physical and chemical properties of soil. The plough layer contains appreciable amounts of plants residues. These organic residues undergo microbial decomposition accompanied by microbial utilization of dissolved oxygen in water. As a result of this the plough layer and the plough sole become reduced and anaerobic conditions set in. Iron and manganese compounds undergo reduction to ferrous and manganous forms. Gley spots appear in the plough layer and the plough sole. Reduced forms of iron and manganese compounds which are soluble move down to the B horizon where oxidised conditions prevail and these ions undergo oxidation to ferric and manganic forms which get precipitated in the B horizon and form reddish brown or yellowish brown mottles. Thus due to the reductive eluviation of ferrous and manganous compounds from the plough layer and oxidative illuviation of ferric and manganic compounds in the B horizon, paddy soil profile develops its specific morphology. This typical process of paddy soil formation is best observed in the paddy soils developed under the influence of surface water. In hydromorphic or ground water soils the B horizon is water logged and therefore reduced. Consequently in these soils oxidative illuviation does not take place and the B horizon remains gleyed.

Differences in morphological characters such as soil colour, gley formation and mottle formation that reflect oxidation reduction conditions in soil, which in turn depend on soil drainage, constitute the main criteria in modern paddy soil classification systems.

Paddy soils are derived not only from mineral soils but also from organic hydromorphic soils by removal of excess water. Therefore systems of paddy soil classification should necessarily include organic paddy soils. For this purpose criteria used in natural soil classification are employed with necessary modifications (Thorp 1935; Buckman and Brady 1964; Kamoshita et al 1967).

PROPOSED SYSTEM OF PADDY SOIL CLASSIFICATION

I. Great Soil Groups

Diagnostic criteria in classifying them are mainly based on the differences in hydromorphism due to the influence of ground water or irrigation water in the case of mineral paddy soils and in organic soils, on the content and degree of decomposition of organic matter.

Eight Great Soil Groups have been identified. These can be re-grouped into three main groups depending on the natural soil prior to Asweddumisation.

(1) Paddy soils derived from alluvial lowland soils—

1. Ground water gley paddy soils.
2. Surface water gley-like paddy soils.
3. Stagnant water gley-like paddy soils.

(2) Paddy soils derived from terrestrial soils—

4. Ground water gley paddy soils.
5. Surface water gley-like paddy soils.
6. Stagnant water gley-like paddy soils.

(3) Paddy soils derived from bog soils—

7. Pest paddy soils.
8. Muck paddy soils.

II. *Great Soil Sub-Groups*

These are transitional soils between two Great Soil Groups.

1. Intermediate gley-like lowland paddy soils.
2. Intermediate gley-like terrestrial Paddy soils.
3. Muck peat paddy soils.

III. *Soil Family*

Characteristics of original soils or materials, which fundamentally control the elementary processes of paddy soil formation are the diagnostic features used in identifying soil families. (Criteria are varied with every group of Great Soil Groups).

1. Derived from alluvial soils (eg. Paddy soils derived from coarse grained alluvial sediments etc.).
2. Derived from terrestrial soils (e.g. Paddy soils derived from reddish brown earth etc.).
3. Derived from bog soils.

Note.—Soil Families are recognised only when obvious differences in soil parent material are observed.

IV. *Soil Series*

Soil Families are classified into Series mainly on the basis of differences in development of paddy soil profile or intensity of

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elementary processes of paddy soil formation, such as intensity of gleyization, mottle formation and bleaching, degree of decomposition of peat and thickness of peat and muck layers. Criteria are varied with every Great Soil Group and Great Soil Sub-group.

(I) Paddy soils derived from alluvial lowland soils—

(1) Ground water gley paddy soils :

Soil Series { 1a. Strongly gleyed.
1b. Gleyed.

(2) Surface water gley-like paddy soils :

Soil Series { 2a. Strongly mottled } In consideration with sub-soil colour.
2b. Mottled

(II) Paddy soils derived from terrestrial soils—

(4) Ground water gley paddy soils :

Soil Series { 4a. Strongly gleyed.
4b. Gleyed.

(5) Surface water gley-like paddy soils :

Soil Series { 5a. Strongly mottled % } In consideration with sub-soil colour.
5b. Mottled

(III) Paddy soils derived from bog soils—

(7) Peat paddy soils :

Soil Series { 7a. Well decomposed } In consideration with thickness of peat
7b. Moderately decomposed } layer.
7c. Ill decomposed

(8) Muck paddy soils :

Soil Series { 8a. Thick.
8b. Medium.
8c. Thin.

(9) Intermediate gley-like lowland paddy soils :

Soil Series { 9a. Strongly pseudogleyed.
9b. Pseudogleyed.

(10) Intermediate gley-like terrestrial paddy soils :

Soil Series { 10a. Strongly pseudogleyed.
10b. Pseudogleyed.

(11) Mucky peat Paddy soils :

Soil Series { 11a. Thick.
11b. Medium.
11c. Thin.

Note.—(1) When identifications of mottles is difficult in the surface wa type they are temporarily accommodated in the mottled series and sub-soil colour is taken as an indication of the degree of development of paddy soil profile.

(2) Thickness of organic layer from surface : more than 50 cm. Thick 20-50 cm. Medium : less than 20 cm. Thin.

V. Soil Types

Soil types are classified on the basis of the texture of the surface horizon. e.g. Coarse textured, Medium textured, Fine textured.

Note.—Coarse textured : Sandy loam, Loamy sand, Medium textured : Sandy clay, Sandy clay loam, Clay loam, Silty clay loam, Silt loam, Fine textured : Heavy clay, Light clay, Silty clay.

VI. Soil Phase

Subdivided or grouped, on the basis of differences in agricultural characteristics, such as agronomic and ameliorative, without itself being a category of the system of classification.

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