AGL:SF/KOR 13
Technical Report 1

SOIL SURVEY

REPUBLIC OF KOREA

THE SOILS OF KOREA

UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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Report prepared for
the Government of the Republic of Korea
by
the Food and Agriculture Organization of the United Nations
acting as executing agency for
the United Nations Development Programme

UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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ABSTRACT

This report describes a soil survey project conducted by the Government of the Republic of Korea, with the assistance of the United Nations Special Fund 1/ and the Food and Agriculture Organization of the United Nations. The project became operational in October 1964 and ended in December 1969. Its purpose was not only to provide information on the soils of Korea, but to establish a soil survey organization which would continue after the project ended. This report is accordingly designed as a reference text for future soil survey work in Korea.

The principal soil unit on which the project's work is based is the soil series, within which all soils may be expected to be sufficiently homogeneous to permit recommendations for practical use. In Part I of the report, the formation, classification, characteristics and qualities of the soils are outlined, and interpretation for use is given; the descriptions of the 104 series recognized are given in Part II.

Korea's soils are largely derived from igneous and metamorphic rocks, with some areas from shales, conglomerates or limestones, and smaller areas from volcanic ash tuff and breccia. Rainfall, largely falling in the summer, has been sufficient to leach bases from upland residual soils, so base saturation on these soils is usually low except on those from limestone and mafic rocks. There are important areas of alluvial soils of fluvio-marine origin on the plains inland from the west and south coasts. Many of the alluvial soils are gleyed. These, as well as the alluvial soils along the streams farther inland, are used intensively for growing rice. Saline soils are limited mainly to areas recently reclaimed from the sea.

The U.S.D.A. (1938) system of classification as applied to Korean soils is briefly outlined, as well as the revised (1960) system, and the soils are classified in both systems. The relations between Great Soil Groups and the FAO World Soil Map units are also shown, and the characteristics of the soil series are tabulated.

1/ The United Nations Special Fund and the Expanded Programme of Technical Assistance were merged to form the United Nations Development Programme on 1 January 1966.

In the capability classification, limitations due to erosion, particularly of the sloping upland soils, play an important part, though waterlogging, and in some areas drought, are also problems. A special paddy suitability classification, with four main levels of suitability, and thirteen limitation classes, is followed by crop suitability ratings for fifteen major crops and for woodland. A discussion of soil limitations for engineering shows how a knowledge of soil depth to bedrock, water tables, particle size, permeability, shrink-swell potential and corrosivity can be useful in local or regional planning.

Soil management is discussed in detail. The drainage of many soils in classes IIw and IIIw would make it possible to grow winter crops of barley and wheat, while fruit and vegetable crops could in many places be improved by irrigation. The erosion problem is discussed and possible solutions presented, with reference to other UNDP projects which have investigated this problem in the field. The acidity problem is very prevalent in most Korean soils, and detailed lime recommendations related to cation exchange capacity and percent base saturation are presented, together with recommendations for selected series. The uses of soil surveys in making fertilizer recommendations are also discussed, in relation to the recent UNDP Soil Fertility Project in Korea (Nov. 1963 to Dec. 1969). Cropping systems should also be designed to take account of soil characteristics: in some areas where water is lacking, better returns would be obtained from crops other than rice, while in others double cropping could be more widely practised.

Part II consists mainly of detailed descriptions of the 104 soil series recognized to date in Korea, described, with minor variations, in accordance with the FAO Guidelines for Soil Description, Analytical data for each series accompany the descriptions, which are prefaced by an account of the method used in the analyses.

The report contains a bibliography, a glossary of over 60 special terms used in soil science, and a soil map of Korea at a scale of 1:1 000 000.

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Part I

SOILS OF KOREA

Chapter 1

INTRODUCTION

The Korean Soil Survey Project was performed by the Ministry of Agriculture of the Republic of Korea, with the assistance of the United Nations Special Fund 1/ for which the Food and Agriculture Organization of the United Nations acted as executing agency. The project became operational in October 1964 and ended in December 1969. This report is devoted to a consideration of the principal technical premises and main results of the work, including brief accounts of the most important factors affecting the understanding and use of the actual series definitions, which make up the bulk of the report. Other technical reports on this project are listed in Appendix 1.

A major purpose of the project, among others, was contributing to the establishment of a soil survey organization which would continue after the assistance provided under this project is discontinued. A soil survey requires the classification of soils and a soils legend showing the kinds of soils mapped. In a continuing programme these must be described in standard terms that can be understood in the same way by different workers. For this reason the project staff devoted a considerable amount of time to the development of concepts of soil units, their description and classification, and the preparation of mapping legends.

The principal soil unit on which the classification is based is the soil series, as the term is now used in the U.S.A. It is recognized that soil is a continuum over the land surface and that volumes of soils rather than profiles are represented on maps. The soil series is made up of soils which below normal ploughing depth (10 to 15 cm), are essentially uniform in their differentiating characteristics and in the arrangement of ~~their~~ genetic horizons, if present.

1/ The United Nations Special Fund and the Expanded Programme of Technical Assistance were merged to form the United Nations Development Programme on 1 January 1966.

Relatively narrow ranges are permitted in properties such as thickness and texture of definitive horizons, but no attempt is made to limit all properties of a series to narrow ranges. It is expected that soils within a series will be sufficiently homogeneous that interpretations and recommendations for practical use can be based upon them, or upon types and phases of them.

The mapping unit commonly used is not the soil series. Types to show surface textures and phases to show such features as slope are used in detailed surveys where they have significance for use and treatment of the land.

The Soil Reconnaissance of Korea 1/ was made largely by photogrammetric methods, followed by field checking. Soil units shown were defined at the Great Group level. In making the reconnaissance, however, hundreds of individual profiles were examined and described and laboratory studies were made of numerous samples. In preparing the descriptions in this report, detailed information from these sources was combined with the observations, descriptions and laboratory studies of soils from thirteen detailed survey areas representing all parts of the country.

In developing the official description of a series the experts and project officers reviewed the field descriptions of the soil and similar soils from detailed soil survey areas and the reconnaissance, and chose a type location. Description of soil at this site was used to typify the series, and permissible ranges in differentiating characteristics were defined, setting the series apart from similar and competing soils.

More than one hundred soil series were defined, including most of the soils of major extent in the Republic of Korea. These descriptions are intended to serve as the basis for future soil surveys. The principles used in defining the series are well established, but individual soil series will be subject to change as more information is obtained about their genesis, extent, properties and response to treatment. As additional survey areas are correlated, refinements in the descriptions of established series as well as definitions of new series are to be expected.

1/ See Appendix 1.

Chapter 2

FORMATION OF KOREA'S SOILS

1. Significance of Soil Formation Factors

Knowledge of the factors which caused the soils to form is helpful in understanding the different kinds of soil and the areas of land which they occupy. The discussions which follow in this section are included for this reason.

As elsewhere in the world, soils in Korea have characteristics resulting from the total combined effects of parent rock, climate, relief of the land, vegetation and associated organisms, and time. Where these five soil-forming factors are the same the soils must be the same. This philosophy was formed by Dokuchaiev near the end of the last century and a great deal of study has since shown it to be true, (Crompton, 1967).

The five soil-forming factors determine the conditions under which soils develop. Physical, chemical and biological processes go on within the soil under the particular set of conditions at any point and cause a particular arrangement of distinctive horizons to form. The processes are numerous and complex. Rock materials are broken down, by physical and chemical means, with some parts passing into solution, in a process called weathering. The products of weathering may be removed from the soil or redistributed within the profile. Plants and animals use some of the products of weathering and return them to the surface or to other parts of the soil.

The surface of every soil is losing or receiving material, eroded or deposited by wind or water. In most areas soils with distinctive horizons have formed, but some areas have not formed soil profiles. Where erosion is excessive, the materials are removed so rapidly that a soil profile can not develop; areas of recent deposition have not had time to develop a profile; and some materials such as pure quartz sand are so resistant to weathering that little soil development can take place.

2. Effects of Parent Materials

The rocks underlying Korea are primarily granite, gneiss, schist, andesite porphyry, shale and limestone, with smaller areas of gabbro, tuff and other volcanic rocks (Geological Survey of Korea, 1956).

The parent material of soils in the mountainous and hilly areas, which includes most of the country, is residual. That is, the soils have formed in place, in materials derived from weathering of the underlying rock. In about 20 to 25 percent of the country, however, including a large part of the agricultural land, the soils have formed in materials washed from higher areas and deposited by water. In the western and southern coastal areas and extending inland along major rivers are extensive fluvio-marine plains consisting of silty and clayey sediments deposited in salt or brackish water or inundated by salt water. These are shown on the General Soil Map in area A1, Low Humic Gley and Alluvial Soils, Fluvio-marine phase. Gimje, Mangyeong, Jeonbug and Gwanghwal are examples of important soil series formed in these sediments. Farther inland along all of the streams are alluvial deposits consisting of mixtures of sand, silt and clay, with gravel, cobbles and stones in many places. The largest areas of these are shown on the General Soil Map as Area A2. At the heads of drainageways in mountainous and hilly areas are local deposits of materials which were moved for short distances, principally by gravity.

Soils formed in recently deposited materials, such as the Sachon and Jisan series, have been only slightly changed by soil-forming processes. In contrast, soils on terraces and benches, such as Bancheon and Hwadong, have been in place long enough to have formed soil horizons.

Parent materials have had a major influence in forming Korea's soils. The granitic rocks are low in bases and have weathered deeply at the lower elevations. The soils formed from them, such as the Songjeong and Jeonnam series, have thick C horizons and are, in general, strongly acid and low in bases, and subject to severe erosion. Schist, andesite and shale have weathered less deeply and the soils formed on them, such as the Oesan, Mudeung, Daegu and Habin series, are shallow soils. Soils formed from shale, such as Daegu, are higher in bases than those formed from granite or schist, and those formed from limestone, such as Pyeongchang, are nearly neutral and high in bases.

Soils in the sediments derived from different sources also show differences related to the parent rock. Sediments from shale and andesite are finer in texture than those from granite. Content of bases varies in much the same way as in residual soils, with some noticeable exceptions. The Bancheon and other series, in sediments washed from granitic materials, show unexpectedly high base saturation.

The materials underlying the soils of Korea are listed in Chapter 5 (Table 3) but the following examples illustrate different soil series derived from various parent materials. It is assumed that the underlying materials are similar to the parent materials of the soils, except in strongly contrasting layers of alluvium.

	Series
Fluvio-marine alluvium	Buyong Mangyeong
Continental alluvium	Ihyeon Nagdong

	Series
Colluvium	Gaghwa Imog Miltan Sinbul
Residuum from: Granitic rocks	Jeonnam Songjeong
Andesite and andesite porphyry	Bonggye Taehwa
Sandstones and shales	Daegu Sirye
Limestone	Jangseong Pyeongchang
Schist and phyllite	Nagseo Oesan
Mafic rocks	Cheongag Jeongja

3. Effects of Climate

Climate affects soil formation by the influence of precipitation and temperature. Water dissolves minerals, supports biological activity, and transports minerals and organic residues through the soil profile. The amount of water that percolates through the soil depends to a large extent on the amount and intensity of precipitation, the relative humidity, and the length of the frost-free period. Percolation is also affected by physiographic position, soil cover, and permeability of the soil.

Temperature influences the kinds of organisms and their growth and the speed of physical and chemical reactions in the soils.

In Korea the soils are moist or wet during the summer and nearly dry for much of the rest of the year. Chemical and biological activity in the soil are intense during June, July and August, the season of greatest rainfall, but much less so in the dry autumn and cold winter months. Rainfall has been sufficient to leach bases from upland residual soils so that base saturation is low or medium except on those developed from limestone and shale. Freezing and thawing during the winter are common except in low areas along the southern coast, and have been important influences in weathering of rocks and formation of soils. Deep weathering and red colours in places apparently indicate a warmer climate during some period of the soil development.

Temperatures and length of growing season vary sufficiently to affect the kind of crops grown. At high elevations in the northeastern areas the season is too short for rice, while at low elevations in the southern and central areas many paddies are used for two crops a year, rice in the summer and barley or wheat in the winter. Soils in the cool climate at high elevations accumulate more organic matter and have darker surface horizons than those from similar materials in warmer areas. Most of these soils are in areas shown as D2 on the General Soil Map. They include the following series:

Bansan	Mui	Wangsan
Cheongsim	Odae	Weoljeong
Chahang	Sinbul	
Mangsil	Ungyo	

Except for the cooler temperatures at high elevations, climatic differences in Korea have apparently not been sufficient to cause major differences in soils.

4. Effects of Relief

The relief of an area is largely determined by the geologic history of the region, including movement of the earth's crust, dissection by rivers and streams, and development of the landscape through retreat of slopes. Relief influences the formation of soils by its effect on surface drainage and movement of water through the soil, and on erosion, temperature and plant cover. The influence of relief is modified by each of the other factors of soil formation.

Much of Korea is mountainous, with slopes ranging to 100 percent. A series of uplifts has left the eastern shore line as an emergent coast, with an abrupt drop from the mountains into the sea in many places. This is in contrast with the west coast which has extensive coastal lowlands with recent fluvio-marine deposits, broad tidal flats, slightly elevated rolling land, and isolated low mountains that extend as islands into the Yellow Sea.

On the steep slopes of the mountains, geologic erosion has removed soil materials rapidly. As a result many of the steep soils have only shallow soil development with weakly defined horizons, and bedrock is exposed in many places. The Gwanag, Mudeung, and Odae series are extensive soils which have formed on very steep mountain slopes. In these and other soils which formed on very steep relief, the qualities of the soils reflect to a large extent the qualities of the parent materials.

Below the high mountains are areas of rolling and hilly land. Here in addition to the shallow soils with little soil development, are steep and moderately steep soils which have remained in place long enough to form distinct horizons of clay accumulation. Dalcheon, Songjeong, Bonggye and Sirye are extensive series which have formed in residuum from weathering of underlying rocks in this position.

Throughout the mountainous and hilly areas are many alluvial-colluvial deposits, in depressions at heads of streams, along the streams and on footslopes. In these positions small differences in relief cause major soil differences because of the effect on drainage. Soils formed in these positions are important agriculturally and a large number of series have been established to classify them. Among the important series are the well drained Baegsan, Gaghwa, Iweon and Seogto series, the moderately well drained Tongcheon, Samam and Yongji series, the somewhat poorly drained Sachon, and the poorly drained Manseong, Jisan and Subug series.

Inland from the west coast are considerable areas of older alluvial plains and terraces which have been elevated and partially dissected, on which soils with strongly differentiated horizons have formed. These include some of the extensive and agriculturally important soil series, such as Bancheon, Changpyeong and Hwadong.

The coastal lowlands are mostly level or nearly level and soils have formed under a water table which is high during much of the year. The most important rice-growing soils of Korea are here, including the extensive Buyong, Gimje, and Jeonbug series.

The slope range and physiographic position of each series, are among the data listed in Table 3 (Chapter 5). This table also shows the resulting natural drainage class. It is possible to group otherwise similar soils in drainage catenas or sequences, showing progressive degrees of natural drainage. An example of a catena of fine clayey soils on old alluvial terrace materials is made up of the Pancheon, Hwadong, Geugrag, and Honam series, which are well-drained, moderately well drained, imperfectly drained and poorly drained respectively. Differences of elevation and slope here are minor, but sufficient to affect natural drainage and soil development significantly.

5. Effects of Plants and Animals

The kinds and numbers of plants and animals that are on and in the soils are important in their development. They are determined by the climate and to varying degrees by the parent material, relief and age of the soil. Large numbers of bacteria, fungi and other forms of microscopic life aid in weathering rock and decomposing organic matter. Larger plants and animals change the climate of the soil where they live. They furnish organic matter and transfer elements from the subsoil to the surface soil.

Earthworms and other small invertebrates carry on a slow, continual soil mixing. Burrowing rodents also mix soil materials.

The original vegetation over most of Korea was forest, but little of the virgin composition remains. Pines, and firs, together with chestnuts, oaks, birches and other broad-leaved trees once covered most of the country, but now large areas of sparse secondary or degraded vegetation and almost denuded land surround densely populated areas. Small areas of grassland occupy some high mountain slopes and plateau positions.

The effects of vegetation and associated animals in Korea are so dependent on other factors of soil formation that series differences can not be readily attributed to them. The series with thick dark surfaces listed in Section 2 above were formed as a result of both climatic and biological factors which favoured accumulation of organic matter. It is probable that other large areas would show more significant characteristics related to vegetation if it were not for the intervention of man.

The activities of man have had a major effect in forming the present soils of Korea. Clearing, cultivation, paddy construction and drainage have influenced most of the cultivated areas, and the cutting of trees and raking of forest litter for fuel have changed surface layers and caused serious erosion in much of the woodland near populated areas.

Land preparation for paddies has modified the soil profile in all of the paddies, except those on land which was naturally level and at suitable elevation. Flood irrigation and control of water tables have changed the natural water behaviour in all areas used for paddy. In naturally well drained soils used for paddy the surface layers have become gleyed because of flooding. Depth to which the gleying extends depends on the length of time in paddy. Noticeable changes can be observed in a period as short as five years.

6. Effects of Time

The length of time that is required for a soil to develop depends on the other factors of soil formation. Less time is required in a humid, warm region where vegetation is dense than in a dry, cold region where vegetation is sparse. In the same environment less time is required for a soil to develop from moderately coarse-textured parent material than from similar but finer-textured parent material.

The ages of soils in Korea vary a great deal. Soils beginning to develop in areas reclaimed from tidelands, or in recent alluvial deposits, may be only a few years old. On the other hand some soils on stable upland positions have developed distinct horizons and may be considered to be mature in soil development, with ages measured in many thousands of years. In most of the country, however, the soils are of recent to intermediate age, having formed in sediments, or on slopes that are undergoing rapid geological erosion.

Chapter 3

CLASSIFICATION OF THE SOILS

1. Principles of Soil Classification

A classification is an ordering or arrangement of objects in the mind and distribution of them into compartments. The purpose of a classification is to arrange the ideas of the objects in such an order that ideas accompany or succeed one another in a way that gives us the greatest possible command of our knowledge and leads most directly to the acquisition of more.

Classification of soils is difficult, for they are highly complex. Every soil body consists of a variety of minerals, an assortment of particles of different sizes, a collection of dilute solutions, and a mixture of gases. Under natural conditions it harbours immense numbers of micro-organisms and is host to numerous plant roots and small animals. The reactions among the components of the soil and between the soil and the life within it are many and varied. Every soil is thus a dynamic system (see FAO Guidelines for Soil Profile Description, 1968). The study and classification of soils require use of a number of other sciences, including geology, physics, chemistry and biology.

Since any classification is an organization of knowledge for a specific objective, there can be no "best" classification except as it serves its objective. The objective of a soil classification system is to have classes of soils defined and arranged so that relationships between them and the factors of their environment become evident, and so that the results of research and experience may be related to each kind of soil, to permit the best possible predictions about their responses to management.

A classification of soils can be either natural or technical. Either kind is an arrangement of ideas about individual soils in classes, so that the soils of a class have certain characteristics in common. A natural classification is one based on characteristics of the soils that can be observed or measured, without inferences about genesis and without implications about significance of the characteristics when the soils are managed. A natural classification, to be useful, needs to be comprehensive. It should take in, for example, all the known soils of a continent or, preferably, of the world; and it should be capable of expansion to take in new soils as they are discovered. A technical classification, in contrast, is often designed to have much more limited conceptual scope and geographical range. A listing of soils suitable for growing barley in the fluvio-marine plain of Korea, for example, is a limited technical classification. The capability grouping of soils is a broader technical classification, but a capability grouping designed for practical use in one country or geographic region can seldom be applied directly in another.

This section deals only with natural classification of soils. Technical groupings, including the capability classification as it is applied in Korea, are treated in Chapter 6.

Of the numerous classifications of soils which have been proposed, two are in widespread use in a number of countries and will be described briefly. One is the classification of soils in orders and great soil groups, which was published by Baldwin, Kellogg and Thorp (1938), modified substantially by Thorp and Smith (1949) and modified slightly by others from time to time. This classification was used throughout the United States and in many other countries, including nearly all of the developing countries that received soil survey assistance from the Food and Agriculture Organization of the United Nations or from foreign aid activities of the United States. It has been applied to thousands of soil series in many parts of the world, and will appear in publications for many years to come. It was used in the work of the Korea Soil Survey Project, exclusively in the first years, and together with the revised classification (U.S.D.A. 1960), during the last two years of the project. It is described briefly in following pages.

The revised soil classification (U.S.D.A. 1960), adopted by the United States in 1965 and modified in 1967, (U.S.D.A. 1967) is also described briefly. This classification is a radical departure from earlier points of view. It is intended to include all soils, leaving room for those not yet discovered. Class limits are fixed in terms of soil characteristics that can be measured or observed uniformly by different people. New names are also incorporated, to lessen the confusion resulting from use of familiar words with new meanings and unfamiliar definitions.

2. Classification and Mapping Before the Project

Soil Survey field work began in Korea in 1936 during the period of Japanese occupation. Following independence in 1945 a Soil Research Institute under the Office of Central Agricultural Research was established by the Republic of Korea, but the work was interrupted by the war in 1950-51. During the period 1945-1958 the Republic of Korea organized the existing data and published semidetailed soil surveys of the cultivated areas in about half of the country. Maps were prepared for the cropland of individual Guns at 1:50 000 scale. The soil classification system was not fully developed, however, and the soil maps were not correlated. Reports in the Korean language including brief descriptions of map units and soil profiles were prepared for each province. The Japanese system of soil classification which was used gave primary emphasis to soil texture, colour, drainage, physiography and parent materials.

During the period 1958-60 the United States Government assigned a soils adviser to train a small number of Koreans in soil survey methods of the United States Department of Agriculture. The classification used was based on the 1938 Yearbook system of genetic Great Soil Groups. A few small areas were mapped, and a beginning was made in the study of individual soil characteristics. The men trained during this time formed the core of the Korean counterpart staff of the soil survey project.

3. Soil Orders and Great Soil Groups (U.S.D.A. 1938 System)

3.1 Classification system

In the soil classification system of Baldwin, Kellogg and Thorp (1938), four categories above the soil series were defined. Beginning with the most inclusive, these categories are the order, the suborder, the great soil group, and the family. The suborder and the family categories were never fully defined, however, and have been little used. In Korea as well as in the United States, attention has been concentrated on the classification of soils into types and series, and grouping of the series into great soil groups.

The zonal order is made up of soils that have well developed soil characteristics, and reflect the influence that climate and living organisms, chiefly vegetation, have had on well drained but not excessively drained soil materials over a long period. Zonal soils are considered to be normal soils. They are in a state of equilibrium, or perhaps more accurately in a steady state, with their environment, and many of their main characteristics are the results of that environment rather than of the parent material. For those reasons soils tend to resemble one another, in many characteristics, over a broad zone where the environment is uniform, even though there are differences, in the kinds of soil materials.

In the intrazonal order are soils that have well developed soil characteristics which reflect the dominating influence of some local factor of relief or parent material over the normal effects of climate and vegetation. Many of the wet soils in Korea that have developed horizons are intrazonal soils.

Azonal soils (soils not occurring in zones) lack well developed soil characteristics because of their youth, or because the nature of their parent materials or relief prevents the development of a normal zonal soil. Azonal soils include those that consist mainly of alluvial sediments little affected by soil-forming processes; deep sands that contain few weatherable minerals; and shallow or stony soils over either hard or fractured rocks.

Each great soil group contains a large number of soils. The soils of each great group have certain internal features in common, but they can differ significantly in features that affect their use and management. Units of classification below the great group therefore are generally needed for mapping soils and interpreting their performance. In the system that has been applied in Korea, the United States, and many other countries, individual soils are classified in types. Soils of one type, or of two or more types if the only difference is in texture of the surface soil, make up a soil series. Each soil series is given a name taken from some geographic feature. The soil series name and the class of soil texture form the name of a soil type; for example, Honam silt loam and Myeongji loamy sand are names of soil types.

Following is a list of the genetic great soil groups (1938 yearbook and supplements) which have been recognized in Korea:

Red-Yellow Podzolic Soils
Reddish-Brown Lateritic Soils
Grey-Brown Podzolic Soils
Acid Brown Forest Soils
Low Humic Gley Soils
Planosols
Bog Soils
Ando Soils
Lithosols
Regosols
Alluvial Soils

3.2 Zonal soils

3.2.1 Characteristics. Characteristics of zonal soils reflect the dominant influence of climate and organisms rather than the nature of the parent material. Most zonal soils are at least moderately well drained and are not excessively steep. Soil horizons are evident to prominent.

3.2.2 Red-yellow podzolic soils. These are the most important zonal soils in Korea. They are extensive throughout the continental part of the country. They are normally acid soils of low base status and high chroma developed from strongly weathered materials in humid, warm temperate to tropical climate. Uneroded profiles have light coloured A2 horizons, but in many places all A horizons have been removed by erosion. Where present they are in many places mixed with the B horizon by cultivation.

3.2.3 Reddish-brown lateritic soils. These are zonal soils of less extent in Korea. They have formed from weathered rocks that are higher in bases than parent materials of Red-Yellow Podzolic soils, and have darker surface soils, redder subsoils and somewhat higher base status than Red-Yellow Podzolic soils. Reddish-Brown Lateritic Soils do not contain a light-coloured A2 horizon. The B horizon contains accumulated clay.

3.2.4 Grey-brown podzolic soils. These are of minor extent. They have leached A2 horizons and B horizons of clay accumulation, of moderate base status and brown colours.

3.3 Intrazonal soils

3.3.1 Characteristics. Characteristics reflect dominance of some local factor of relief or parent material in soil formation. Horizons are evident to prominent.

3.3.2 Acid brown forest soils. These soils are common at high elevations. They have thick dark coloured surface layers with greater than average content of organic matter. (Because their distribution correlates closely with local climatic factors these dark soils might be considered zonal.)

3.3.3 Low-humic gley soils. Poorly or very poorly drained mineral soils, with grey or greyish-brown mottled, or grey unmottled subsoils and substrata. Textures of surface soil and subsoil vary. Base status is commonly high.

3.3.4 Planosols. Mineral soils that contain one or more horizons that contrast sharply with an adjacent horizon because of high clay content, cementation, or compactness. In Korea the Planosols are limited to small areas of sloping and moderately steep, moderately well drained soils with fragipans, commonly on concave foot slopes and fans.

3.3.5 Bog soils. These are organic soils in swamps or marshes. Only very small areas of Bog soils are known in Korea now, although larger areas which have had organic soil accumulation have been covered by 50 to 150 cm of sediment and are now mapped as mineral soils.

3.3.6 Ando soils. These are dark soils on volcanic ash, containing amorphous clay. They are limited in extent to the volcanic island of Jeju and small islands nearby.

3.4 Azonal soils

3.4.1 Characteristics. Horizons are not evident, except for darkening of the surface layer.

3.4.2 Lithosols. This great group is extensive, occupying a large part of the mountainous areas as well as significant amounts of hilly and rolling lands. Lithosols have developed in weathered rock, without distinctive horizons below the A horizon. Normally they are less than 50 cm deep over saprolite or rock and are rocky and stony.

3.4.3 Regosols. These are soils with very weakly developed horizons in deep unconsolidated materials.

3.4.4 Alluvial soils. These are imperfectly to excessively drained soils with only faintly developed horizons, developing in recent alluvium. They are dominantly on natural levees along main stream channels, on marine deltas, and on low inner floodplains in degrading valleys.

4. Revised Classification Scheme of U.S.D.A.

4.1 Introduction of the revised scheme

The revised soil classification scheme of the United States Department of Agriculture was proposed in preliminary form in 1960, and adopted for use in the United States in 1965. Further modifications were summarized in a supplement issued in 1967. Four regional publications showing the placement of all established soil series in the United States in families and higher categories of the new system were issued during the following year. While this scheme is designed to accommodate all possible soils, it is recognized that additions of classes and refinements of definitions will be necessary as new information on the properties and extent of soils is obtained. A publication incorporating all of the revised scheme of classification with supplements to date is planned for early release.

During the first three years of the Korea Soil Survey Project soils were classified according to the principles outlined in Baldwin, Kellogg and Thorp (1938). Classification of soils in the Soil Reconnaissance is based upon the Genetic Great Groups of this system, although some qualifications are necessary in use of names, such as "Red-Yellow Podzolic soils with high base status".

When the revised classification became available, its principles were adopted as a basis for establishing units. Series are now placed into families and higher categories of the system when the official series description is prepared or revised. They are also classified as far as possible in Genetic Great Groups of the 1938 system. Series descriptions in this report include Genetic Great Groups as well as the higher categories of the revised system.

4.2 Why a new system of soil classification?

In discussing this question Charles E. Kellogg (1963) gave a number of reasons for revising definitions of great soil groups:

1. Many concepts of great soil groups are based on factors outside the soil, and definitions are ambiguous.

2. Definitions of the three orders are ambiguous.

3. Some soils are classified on properties that are destroyed under culture.

4. Definitions have been attempted in terms of too few properties.

5. Nomenclature of many great soil groups suggests overemphasis on colour.

6. The nomenclature for great groups evolved from several languages, so that with mixtures of nouns and adjectives it is difficult to name intergrades.

Marlin G. Cline (1961) pointed out further that old definitions were vague, whereas in the new system boundaries between classes are drawn on the basis of quantitative values. Vagueness of definition caused difficulty in placing many of Korea's soils in genetic great groups. Large areas considered Lithosols do not meet a rigid application of this great group definition. Acid Brown Forest Soils as defined in Japan and the so-called "Acid Sulphate" soils present problems in classification because of uncertain differentiae. Some Red-Yellow Podzolic soils are typical of the great group, but others of very similar morphology have high base status and for this reason do not fit the group.

When laboratory data accompany a complete description the soil can be placed in the revised classification. Difficulty in placing soils in this scheme stems from lack of sufficient observations and data to represent a proposed series concept sufficiently. This lack can be overcome as knowledge of each soil is accumulated.

Application of new definitions of higher categories of classification has not changed the basic unit, the series, in principle. Some adjustment in boundaries between series is needed because of new and sharply drawn lines in categories above the series. For example, textures are defined and differentiated at the family level. Series have not always been separated by texture at the same point. The family texture criterion has proved to be a very useful differentia in maintaining uniformity, but its application serves to divide some older series and in other cases draws the line between series at a different point than has been used in the past. In general, however, the concept of the soil series as it has been used in Korea is unchanged by the new system.

4.3 The basis of the classification

Classes of the new system are defined in terms of soil properties that can be observed or measured. The properties used are selected as far as possible to group together soils which were formed by similar processes, but genesis is not used in the definitions. A soil can be placed in the system by its characteristics alone, without reference to its genesis.

Terms for describing soil characteristics are given in the FAO Guidelines for Soil Profile Description (1968) and more fully in the Soil Survey Manual of the United States Department of Agriculture (1951). Each horizon must be described separately. Revised definitions of ABC nomenclature are given in a supplement to the Soil Survey Manual published in May 1962, and are also included in Soil Classification; a Comprehensive System, 7th Approximation (1960).

4.4 Diagnostic horizons

The new system places emphasis on the presence or absence of certain horizons in the soil, which show the kind of soil forming processes that have gone on and the degree of development. These are called "diagnostic horizons". Six kinds of diagnostic surface horizons, six kinds of diagnostic subsurface horizons, two kinds of dense subsoil layers called "pans" and three kinds of other horizons are described and given conventional symbols of designation. Brief definitions of these horizons are given in the Glossary (p.310). For full definitions of each kind, publications on the revised classification should be consulted.

4.5 Categories of the revised system

Six categories make up the revised classification system. Beginning with the broadest, these are order, suborder, great group, subgroup, family and series. They are defined briefly as follows. 1/

4.5.1 Order. The criteria for separating the orders are based on the presence or absence of genetic horizons. Five orders are represented by the series described in Korea - Entisols, Inceptisols, Mollisols, Alfisols, and Ultisols.

Entisols are young soils that do not have genetic horizons or have only the beginning of such horizons.

Inceptisols are soils in which horizons have started to develop but which do not have clay-enriched horizons. They are generally on young, but not recent, land surfaces.

Mollisols are soils with friable, dark coloured surface layers that are well saturated with bases.

Alfisols are soils that contain a clay-enriched B horizon and have moderate to high base saturation.

Ultisols are soils that contain a clay-enriched B horizon and have low base saturation.

1/ Full definitions of categories and classes are given in Soil Classification, a Comprehensive 7th Approximation, United States Department of Agriculture, 1960; and Supplement to Soil Classification System, United States Department of Agriculture, 1967, amended, 1968. In using the classification system, soil survey officers must be familiar with definitions as they are given in these references, which are available in the Soil Survey Library.

4.5.2 Suborder. The criteria for separating the suborders in Korea are the presence or absence of waterlogging, or colours indicative of the condition, the presence of a thick dark coloured surface (umbric epipedon), very sandy textures, or indications of recent water deposition. Aquents, Aquepts, and Aqualfs are separated from the other soils on the basis of wetness. The Umbrepts are separated from the other Inceptisols because of their dark-coloured surfaces. The Psamments are separated from other Entisols on the basis of their very sandy textures. The Fluvents are classified on the basis of their content of organic matter deep in the profile or an irregular distribution of organic matter through the profile, characteristics indicating deposition by water. The Orthents, Ochrepts, Udalfs, Udolls, and Udults have only the characteristics typical of their order.

4.5.3 Great group. The criteria for the great group are more varied. The Udifluvents, Udorthents, Udipsamments, Haplumbrepts, Hapludolls, Ochraqualfs, and Hapludults all have only the characteristics typical of their suborder. The Aquents that are very sandy are separated as Psammaquents from the more typical Aquents or Haplaquents. The Dystrochrepts, Eutrochrepts, and Fragiochrepts are distinguished from each other by low base saturation, high base saturation, and the presence of a fragipan. The Rhodudults are separated from the Hapludults by their dark red colour.

4.5.4 Subgroup. In the subgroup the soils thought to be most representative of the group are classed as Typic subgroups. The soils which are not typic but have some characteristics of other suborders or great groups have names connotative of the relationships. Thus, Fluventic, Umbric, and Dystric subgroups indicate some resemblance to the Fluvents, Umbrepts, and Dystrochrepts. The Lithic subgroup refers to hard rock within 50 cm; the Aquic subgroup refers to indications of occasional high water tables, and the Aeric subgroup refers to better aeration and drainage than typical for the great group. Humic refers to a soil with a dark coloured surface high in humus or organic matter.

4.5.5 Family. The family grouping as used in Korea is based mainly on the texture of the plant rooting zone. The average texture is used except for strongly contrasting textures where both textures are stated such as fine loamy over sandy. Reaction classes are used for the soils in those suborders, except the sandy ones, lacking definition of base status in the higher classification. These are the Haplaquents and Haplaquepts.

4.5.6 Series. The soil series, the lowest category of the classification system, is the basic classification unit.

It consists of a group of soils that formed in a particular kind of parent material and having genetic horizons that, except for the texture of the surface soils, are similar in differentiating characteristics and in arrangement in the soil profile.

Although the soil type is not included as a category in the revised classification system, soil types are used, in Korea as well as in the United States, to name mapping units and to express differences in surface layer textures which are significant in use and management.

5. Classification of Soils of Korea

Table 1 lists the soil series which have been mapped and correlated to date in Korea. Placement in the new classification scheme has been made by the project staff according to class definitions as of July 1968. Not all of the series placements are firm. In some cases there is lack of sufficient data for firm classification and the placement must be regarded as subject to change if new data show the need for it.

Placement of certain of the series of paddy soils is in question for a different reason. Here long-continued flooding for irrigation of rice has resulted in gleying from the surface downward, in some places obscuring the effects of a natural fluctuating groundwater table. An attempt has been made to distinguish degrees of natural drainage at the series level, even though present soil colours do not show normal gradations of brown and grey.

Placement in great soil groups of the 1938 classification is also made in series descriptions, for the convenience of the soil scientists who are familiar with this system. For many series this placement is less certain than that in the revised classification, because of the vagueness of great group definition discussed previously.

6. Relations of Great Soil Groups and FAO World Soil Map Units in Korea

Table 2 shows the general relations among the Great Groups of the revised classification, the 1938 Yearbook Great Soil Groups, and the Soil Units of the FAO Soil Map of the World. These relations can only be approximate, as somewhat different criteria were used in making separations and there is a considerable amount of overlapping.

Table 1

CLASSIFICATION OF THE SOILS OF KOREA

Entisols, soils without distinctive horizons other than an ochric epipedon or weakly expressed surface horizons	Aquents, Entisols that are saturated with water or have grey colours resulting from such saturation	Haplaquents, Aquents except those of loamy sand or sand textures	Typic Haplaquents, the common or typical ones and without characteristics listed in other subgroups of this great group	coarse loamy over sandy skeletal Subug
				coarse silty, nonacid Gwanghwal
			Fluventic Haplaquents Haplaquents deposited by water as evidenced by an irregular decrease in organic matter	
		Psammaquents, Aquents with sand or loamy sand textures	Typic Psammaquents, the common or typical ones	sandy Sindab
	Fluvents, Entisols with an irregular decrease in organic matter indicating they were deposited by water, and with textures of loamy very fine sand or finer	Udifluvents, Fluvents in a humid climate	Typic Udifluvents, the common or typical ones	coarse loamy over sandy, nonacid Bonryang
				coarse loamy, acid Jungdong
			Aquic Udifluvents, Udifluvents with some grey colours in the lower part indicative of seasonal water table	coarse loamy, nonacid Maryeong
	Orthents, Other Entisols with textures of loamy very fine sand or finer	Udorthents, Orthents in a humid climate	Lithic Udorthents, Udorthents with hard rock within 50 cm of the surface	fine loamy Jangseong

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Table 1 (Cont'd)

	Psamments, Entisols with textures of loamy fine sand or coarser	Udipsamments, Psamments in a humid climate	Typic Udipsamments, the common or typical ones and without characteristics listed in the other subgroups of this great group	sandy skeletal Ibseog Hwangryong
				sandy Hwabong Nagdong Togye
			Aquic Udipsamments, Udipsamments with some grey colours in the lower part indicative of seasonal water tables	sandy over loamy Sadu
Inceptisols, soils without distinctive horizons other than a cambic horizon or umbric epipedon	Aquepts, Inceptisols that are saturated with water or have grey colours resulting from such saturation	Haplaquepts, Aquepts with only a pale coloured surface and a cambic horizon	Typic Haplaquepts, the common or typical ones and without characteristics listed in the other subgroups of this great group	coarse loamy, nonacid Hamchang
			Aeric Fluventic Aplaquepts, Haplaquepts with a dominantly brown horizon indicating better drainage (and the presence of air) in the upper horizons and with an irregular decrease in organic matter indicating that the soils were deposited by water	

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Table 1 (Cont'd)

		coarse loamy, nonacid Sachon Seoggye fine loamy, nonacid Sinheung fine loamy over sandy skeletal, nonacid Manseong fine silty,nonacid Jeonbug Yuga fine silty over sandy Daldong
	Fluventic Haplaquepts, Other Haplaquepts with an irregular decrease in organic matter in- dicating they were deposited by water	coarse silty, nonacid Mangyeong fine loamy, acid Baeggu fine loamy,nonacid Hyocheon Jisan fine loamy over sandy, nonacid Gangdong fine silty, acid Bongrim Beunggu Gimhae Haecheog Sugye fine silty over sandy, nonacid Hagseong fine silty,nonacid Deogha fine clayey,non- acid Bongnam Buyong Gimje Gongdeog

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Table 1 (Cont'd)

	Ochrepts, other Inceptisols with only an ochric epipedon or weakly expressed surface horizons and a cambic horizon	Dystrochrepts, Ochrepts with a low base saturation (lacking a horizon within 75 cm of the surface with a base saturation of more than 60 percent)	Typic Dystrochrepts, the common or typical ones and without characteristics listed in other subgroups of this great group	loamy skeletal Oesan coarse loamy Iweon Samgag Ulsan fine loamy Cheongsim Sinjeong fine silty Yuha
			Aquatic Dystrochrepts, Dystrochrepts with some grey colours in the lower part indicative of seasonal water tables	loamy skeletal Tongcheon
			Lithic Dystrochrepts, Dystrochrepts with hard rock within 50 cm of the surface	loamy skeletal Gwanag Nagseo fine loamy Mudeung
			Umbric Dystrochrepts, Dystrochrepts with a dark coloured surface that is similar to an umbric or mollic epipedon except it is too thin to qualify as an umbric epipedon but at least 15 cm thick	coarse loamy Mui
		Eutrochrepts, Ochrepts with a high base saturation (have some horizon within 75 cm of the surface with a base saturation of 60 percent or more). Typic Eutrochrepts not found in Korea, have calcium or magnesium carbonates in the soil mass		

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Table 1 (Cont'd)

		Aquic Dystric Eutrochrepts, Eutrochrepts with some grey colours in the lower part, indicative of a seasonal water table and lacking carbonates in the soil mass	loamy skeletal Jangju fine loamy Samam
		Aquic Fluventic Eutrochrepts, Eutrochrepts with some grey colours in the lower part indicative of a seasonal water table and with an irregular decrease in organic matter indicating that the soil was deposited by water	coarse silty Gyuam fine loamy Yongji fine loamy over sandy Hagsan
		Dystric Eutrochrepts, Eutrochrepts that lack carbonates in the soil mass	clayey skeletal Mitan
		Dystric Fluventic Eutrochrepts, Eutrochrepts that lack carbonates in the soil mass and have an irregular decrease in organic matter indicating the soils were deposited by water	loamy skeletal Seogto coarse loamy Imdong Sangju Seongsan coarse silty Ihyeon fine loamy Anmi Baegsan Banho
		Lithic Eutrochrepts, Eutrochrepts with hard rock within 50 cm of the surface	loamy skeletal Daegu coarse loamy Habin fine loamy Jeongja
	Fragiochrepts, Ochrepts with a fragipan	Typic Fragiochrepts, the usual or common ones	fine loamy Jangweon

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Table 1 (Cont'd)

	Umbrepts, Inceptisols with thick dark coloured surface horizons (umbric epipedons) and low base saturation	Haplumbrepts, without other distinguishing characteristics and in a temperate climate	Typic Haplumbrepts, the common or typical ones without characteristics listed in the other subgroups in this great group	loamy skeletal Sinbul coarse loamy Weoljeong fine loamy Chahang
			Lithic Haplumbrepts, Haplumbrepts with hard rock within 50 cm of surface	coarse loamy Odae
Mollisols, Soils with thick dark coloured surface horizons and having a high base saturation (mollic epipedons)	Udolls, Mollisols in a humid temperate climate	Hapludolls, Udolls without other distinctive horizons	Fluventic Hapludolls, Hapludolls with an irregular decrease in organic matter indicating that the soil was deposited by water	loamy skeletal Hogye Maji sandy Myeongji coarse loamy Imog
Alfisols, soils with a subsoil enriched in clay (argillic horizon) and having a base saturation of more than 35 percent at 125 cm below the top of the argillic horizon or in the layer above hard rock if shallower	Aqualfs, Alfisols that are saturated with water or that have grey colours resulting from such saturation	Ochraqualfs, Alqualfs without horizons other than an ochric epipedon or pale coloured surface and the argillic horizon that is common to all alfisols	Typic Ochraqualfs, the common or typical ones and without characteristics listed in the other subgroups	fine loamy Yeongsan fine clayey Honam
			Aeric Ochraqualfs, Haplaquepts with a dominantly brown horizon indicating better drainage (and the presence of air) in the upper horizons	fine clayey Geugrag
	Udalfs, Other Alfisols in a humid temperate climate	Hapludalfs, Udalfs without other distinctive horizons.	Typic Hapludalfs, the common or typical ones and without characteristics listed in the other subgroups	clayey skeletal Banggi fine loamy Anyong Buyeo fine clayey Bancheon Chengpyeong Pyeongan Sirye very fine clayey Pyeongchang

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Table 1 (Cont'd)

			Aquic Hapludalfs, Hapludalfs with some grey colours in the lower part indicative of a seasonal water table	fine clayey Gongseong Hwadong
			Ultic Hapludalfs Hapludalfs with base saturation of less than 60 percent at 125 cm below the top of the argillic horizon or in the layer above hard rock if shallower	fine clayey Chundo
Utisols, soils with a subsoil enriched in clay (argillic horizon) and having a base saturation of less than 35 percent 125 cm below the top of the argillic horizon, or in the layer above hard rock, if shallower	Udults, Ultisols in a humid temperate climate	Hapludults, Udults with subsoil that is not dark red, dark reddish brown, or dusky red (colour values 4 or more moist, 5 or more dry)	Typic Hapludults, the common or typical ones and without characteristics listed in the other subgroups below	fine loamy Sinhyeon Songjeong Taehwa fine clayey Donggye Dalcheon Gaghwa Gwangju Gwangsan Jeonnam Jingog
			Humic Hapludults, Hapludults with dark coloured surfaces similar to umbric horizons but too thin to qualify as umbric horizons	fine loamy Mangsil fine clayey Bansan Ungyo Wangsan
		Rhodudults, Udults with subsoil colours of dark red, dark reddish brown, or dusky red (colour values of 3 or less moist, 4 or less dry)	Typic Rhodudults, the common or typical ones	fine clayey Cheongog

Table 2

COMPARISON OF SOIL CLASSIFICATION SYSTEMS
FOR KOREAN SOILS

Great Groups 1967 U.S.D.A. Soil Classification	Great Soil Groups 1938 Yearbook and Supplements	Soil Units FAO/UNESCO Soil Map of the World (1970)
Haplaquents	Alluvial Low Humic Gley-Alluvial	Eutric Fluvisol
Psammaquents	Alluvial	Eutric Fluvisol
Udifluvents	Alluvial	Dystric Fluvisol
Udorthents	Regosols, Lithosols	Eutric Regosols
Udipsamments	Alluvial	Dystric Regosols
Haplaquepts	Low Humic Gley Low Humic Gley-Alluvial "Acid Sulphate"	Eutric Fluvisols Dystric Fluvisols Eutric Gleysols Dystric Gleysols Thionic Fluvisols
Dystrandepts	Ando Soils	Ochric Andosols Humic Andosols
Dystrochrepts	Lithosols, Regosols, Acid Brown Forest Alluvial	Dystric Cambisols Rankers
Eutrochrepts	Alluvial Alluvial-Red Yellow Podzolic Alluvial-Low Humic Gley Regosols	Eutric Cambisols
Fragiochrepts	Acid brown forest soils	Dystric Cambisols
Haplumbrepts	Acid Brown Forest Lithosols	Humic Cambisols Rankers
Hapludolls	Alluvial	Haplic Phaeozems

Table 2 (Cont'd)

Great Groups 1967 U.S.D.A. Soil Classification	Great Soil Groups 1938 Yearbook and Supplements	Soil Units FAO/UNESCO Soil Map of the World (1970)
Ochraqualfs	Low Humic Gley	Gleyic Luvisols
Hapludalfs	Red-Yellow Podzolic (with high base status) Grey Brown Podzolic	Orthic Luvisols
Hapludults	Red-Yellow Podzolic Acid Brown Forest	Orthic Acrisols
Rhodudults	Reddis-Brown Lateritic	Acrisols Nitosols
Histosols (classified at order level only)	Bog soils	Histosols

Chapter 4

PROCEDURES IN MAPPING AND CORRELATION

1. General Principles

The mapping of soils involves the construction and testing of a mapping legend, examination of soils, plotting of soil boundaries on the maps, field reviews of the concepts of mapping units and the accuracy of mapping, and description of each mapping unit. Correlation is the process of defining and comparing the significant characteristics of a soil with those of soils already defined and named in the natural classification system; thereby the soil is given a name and placed in the system. The processes of constructing a legend, mapping soils, describing soils, and correlating soils cannot be carried on separately. All the knowledge of soils that can be obtained about soils in the mapping area and their relation to soils elsewhere, including results of laboratory tests, must be used in all phases of the soil survey.

2. The Mapping Legend

Construction of the mapping legend is one of the first steps, and possibly the most important step, in making a soil survey. After five years of work by the project, (including the soil reconnaissance and detailed surveys in thirteen guns throughout the country) it is now possible to go into a new survey area in Korea with reasonable expectation of soil conditions to be met. Most of the major soils will have been identified and described already.

The first draft of the mapping legend is prepared during the first inspection of the mapping area. The Soil Correlator, Field Supervisor and Party Chief with members of the survey party spend five to ten days studying the area in detail. They list the soils which are already described and established, and note representative sites. They study areas of new soils and write complete descriptions. When possible they decide if a new series is needed; if this decision is not possible they make plans for more study. The inspection party studies surface texture and determines the need for types, and for phases to show important differences in slope, erosion, stoniness, rockiness, and other conditions which would affect significantly the use of the soil. The amount of detail which can be shown on the map and the inclusions which must be included in mapping units are also discussed and agreed upon by the inspection party.

The descriptive legend and the soil identification legend are prepared in preliminary form by the survey party chief with the assistance of the Area Supervisor and the Soil Correlator, following the first inspection of the survey area. They are kept up to date by making necessary changes and additions as the survey progresses. Field mapping symbols are assigned for each mapping unit and listed in the identification legend.

Mapping units are commonly soil types for the soils which are level or nearly level, and phases for soils which have a considerable range of slope. Complexes are used in areas having two or more soils in such an intricate pattern that they cannot be separated at the map scale used. Soil associations and miscellaneous land types are used where necessary, to show general soil occurrence. Units are grouped in the identification legend according to some convenient means such as solum texture, physiography, or geology.

The descriptive legend names the dominant and minor kinds of soils in the mapping units, refers to their standard series description and gives their approximate proportion and extent. The description of the mapping unit describes the soil textures, thickness, colour, physiographic position, shape of slope, drainage pattern, inclusions of other soils, characteristic vegetation and relationship to associated soils shown on the map. As the survey progresses, increased information on land use recommendations and management requirements are included.

The mapping legend, constructed in the first stage of the survey, is tested continually as the work progresses. A good legend must include units which will provide affirmative answers to three questions:

(1) Are the soil units mappable? Some soil units which are distinct in the classification system occur only as small areas which can not be shown individually on maps.

(2) Does the legend have a clear place in it for each kind of soil found in the field? If it is difficult to distinguish one kind of soil from another it is probable that the limits of characteristics defined for the soils do not meet at a boundary which is logical in relation to the genesis of the soils.

(3) Can predictions about the performance of the many areas of a soil be made consistently? Broadly defined units may vary too much in response to treatment. On the other hand, narrowly defined units may not show significant differences in response to any treatments now being used. Before combining such mapping units, however, the party chief must be reasonably sure that the soils do not have important genetic differences, and that differences in response to new uses cannot be expected.

3. Examination and Description of the Soils

Soils are examined in many places, in pits and borings, while the map legend is being constructed. After a fairly complete legend has been made, systematic examination and mapping of the soils begins. The object is to find the boundaries between different mapping units and to plot the boundaries between them.

The most recent available aerial photographs are used as base maps. The soil surveyor must know his exact location at all times. He should plan his traverse across a landscape so as to make borings in each significant part; along the top of a ridge, on the side slopes, on alluvial fans, on benches and footslopes, on floodplains and terraces, in wet spots and in other spots which might have distinctive soil.

The soil surveyor observes the entire landscape including steepness, length and shape of slope, kinds and growth of crops, kinds of trees and other native plants, kinds of rock, gullies and other evidence of erosion, and many facts about the soils. Many holes, either bored or dug, are made to study the soil profiles and underlying materials. Holes are not made at regular intervals. In paddies and other intensively cultivated areas the holes are closely spaced. They may be much closer than 100 m. Some soil boundaries which must be established with the auger require many holes. Other boundaries are associated with an easily seen landscape feature. In hilly and mountainous areas stones, rock outcrops, gullies and other exposures of the soil are important indicators of the kind of soil, and the holes are bored at greater intervals than in level croplands. In some of the completed detailed soil survey areas it is estimated that the soil profiles have been examined at intervals of about 200 m on the average, including the hilly and mountainous areas.

Obtaining good descriptions of soils is an important part of the party chief's responsibility. Numerous soil profiles of each soil are described, as well as the common features outside the profile. After sufficient knowledge of a soil's occurrence is obtained, a representative profile is selected and a complete description, including the ranges of characteristics, is prepared. The soil description then includes observed facts about the horizons in the profile and underlying layers, and environmental features. Inferences about certain qualities which cannot be observed directly are also included, such as natural drainage class, permeability, surface runoff, water holding capacity, and erodibility.

Standard terminology must be used, in order that workers other than the writer may use the descriptions. Many common words have been given special or restricted meaning for this purpose, and some new ones have been introduced. Standard references used in Korea are the FAO Guidelines for Soil Profile Descriptions (1968), the U.S.D.A. Soil Survey Manual (1951) and Soil Classification, A Comprehensive System, (U.S.D.A. 1960, 1967).

Adequate objective descriptions of soils should be reproducible by different workers. For example, closely similar descriptions of a soil profile should be obtained if two or more persons describe it or if the same person describes it more than once. It is not enough to have adequate standards and terminology, although these are essential. Men must be trained to observe the characteristics and to use the standard terms, and must check their judgment from time to time with other competent scientists.

4. Characterization of Soils in the Laboratory

Many of the important characteristics of soils cannot be observed and measured in the field. Soils are identified and boundaries are drawn in the field by means of distinguishing morphological features. The important physical and chemical features which cannot be observed in the field must be determined in the laboratory and a relation between the field and laboratory features must be established.

For this purpose samples from carefully chosen and described representative sites of each series are brought to the laboratory for analysis. The details of the analyses performed and the procedures used are given in Part II of this report. The results of these analyses when properly related to the field studies, can be used as criteria for classification and as guides in mapping. Many of the criteria of the classification now being used require laboratory data in their application. The laboratory also helps to check the field methods in order to make sure that no unusual situation is interfering with the field methods used. Detailed laboratory studies related to soil genesis, micromorphological studies of the soil fabric, analyses of clay cutans, concretions etc., lead to improved understanding of the soils in the field by the field scientists. The laboratory data are indispensable in setting up the ranges in characteristics for each series and for interpretation of the soils in recommendations for use and management.

5. Correlation of the Soils

Correlation begins with the examination and description in the field by the surveyor. It continues until the occurrence of the soil in the field is known, the soil is defined by setting limits to its important characteristics, and it is named and placed in the natural classification system, which shows its relationship to other soils.

At the conclusion of the soil survey of a specific area a careful review of the field work is made to study the units mapped, the accuracy of the mapping, the relation of the units to those mapped elsewhere, and the need for combinations and changes in the legend. As a final step in correlation of a survey, the soil correlator approves formally the list of map units which is to be shown on the prepared soil map of the area, the name by which each is identified, and the description of each. If he finds that the new information from the survey requires changes in approved and established series descriptions, he provides for the changes to be made.

The new or revised descriptions are filed and circulated to the soil survey officers and others who need the information.

Procedures necessary for correlation have been mentioned in discussions of the mapping legend, description of soils, and characterization of soil units by laboratory study. Beginning with the final field review, the necessary steps in soil correlation include:

(1) Final field review. The soil correlator, or an officer designated by him, reviews the field notes. He examines representative mapping units, and determines to his satisfaction that the soils have been consistently mapped and adequately described. If map revision is necessary he arranges for it to be done. He reviews the list of soils sampled, and asks for additional samples if he believes any are needed to permit proper characterization and classification of the soils.

(2) Study of soil maps, descriptions, and data. The soil correlator and staff study the soil maps, descriptions, and analytical data from the soil survey in relation to the approved descriptions of soil series, the reports of other soil surveys, and the criteria of soil classification.

(3) Study conference. A conference of the survey party chief and party, the field supervisor and the soil correlator is held to study all available evidence. The necessary changes and combinations of units are made and names are approved for the units which are to be used on the final map.

(4) Filing of soil correlation data. The soil correlator prepares, signs, and places in the file a soil correlation memorandum that lists each field mapping symbol, the field name if one was given to the mapping unit during the field soil survey, and the approved name by which the soils of that mapping unit are to be designated on the soil map and in the soil survey report.

(5) Listing of map symbols. The soil correlator prepares or supervises the preparation of a list of map symbols for the final soil map, and ensures that these are used and identified correctly on maps prepared for immediate use and for publication.

Chapter 5

SOIL CHARACTERISTICS AND QUALITIES

1. Significance of Soil Characteristics and Qualities

A growing plant needs support, nutrients, water, air and light. Support, nutrients and water must be furnished by the soil. Most crop plants (rice is an exception) need to have soil air in contact with their roots, and will not grow if water fills the soil pores and shuts out the air for more than one or two days.

An ideal arable soil for most crops has a deep rooting zone, easily penetrable by air, water, and roots. It holds water between rains but allows the excess to pass through and drain away freely. It has a balanced supply of nutrients. It can be kept from washing away during rains and from blowing away during high winds. Rice has special water requirements, and the ideal soil for that crop is level or can be made so, contains a balanced supply of nutrients, can be flooded while the crop is growing, and does not allow excess water to pass through too readily.

Most soils in their natural state fall short of the ideals that have just been described. The characteristics of almost every soil limit its use to some degree. Some of the limitations can be modified; for example, nutrients can be added in fertilizer, soil structure can be improved by adding organic matter, and many fields can be drained or irrigated. Other limitations cannot be changed but must be tolerated and the system of farming must be adjusted to them; for example, a sloping field yields runoff water that may cause erosion, a sandy soil is likely to be droughty, and many clay soils drain slowly and are sticky when wet. Successful culture of crops or other plants requires management to overcome the limitations of the soil, as well as management to grow and protect the plants.

The performance of a soil needs to be stated in reference to a defined level of management. With a high enough level of inputs, almost any use can be made of any soil. A botanic garden in Seoul, for example, can change the environment of a soil by building a glass house, and can grow bananas, but of course cannot produce the fruit at reasonable cost. This extreme example helps emphasize the point that every statement about the yield or performance of a soil has behind it several economic assumptions, whether they are stated or not. These assumptions must be examined from time to time, and the performance of the soils may have to be re-interpreted, when new varieties of crops, or new combinations of crop-producing technology, make the old assumptions and interpretations out of date.

The unit of soil interpretation is a kind of soil; that is, a taxonomic unit. The most specific statements about performance of soils can be made about phases of soil types. (Some types are uniform enough, even in the cultural environment, for there to be no need to divide them into phases.) Interpretations by phases of soil types can be made with precision if there is enough experience and data. In an area with many soil types and phases, however, the interpretations in that form are extremely detailed; so for some purposes they must be generalized.

To simplify some kinds of interpretations, practical soil groupings are made. The purpose of the grouping needs to be defined with care. A general grouping, useful in general planning of agricultural production, but not detailed enough for many interpretations, is the system of land-capability classes and subclasses. For some purposes a more limited and specialized grouping is more suitable, such as the grouping into four classes of suitability for a particular crop. In every grouping, however, individual differences are perforce combined, and in the combination some precision is lost.

The unit of soil management is a field or a farm; or in some cases a larger unit such as a drainage basin. Any practical unit of soil management is likely to have in it soils of different kinds. The land operator needs to know the distribution of soils of different kinds, and the characteristics and expected performance of each. Then, if a single field or operating unit contains contrasting soils, he may be able to vary the treatment of some of them, and at least can be prepared for different responses if he decides on uniform cropping and treatment.

Soil characteristics and qualities affect the responses when plants are grown. Soil characteristics are the items that can be seen or measured, such as the depth of soil, grain size, amount of organic matter, reaction, content of plant nutrients, soil structure, and waterholding capacity. Soil qualities are the results of interactions between soil characteristics and practices, or between characteristics and the environment. Examples are soil fertility, soil productivity, and, for practical purposes, the class of natural soil drainage. Qualities cannot be measured directly but must be inferred from the characteristics that can be observed or measured.

2. Effects of Characteristics and Qualities on Use

2.1 Slope

A very obvious characteristic of soil is slope. Nearly level soils that are drained or can be drained are most desirable. These have little erosion hazard and can be easily adapted to many uses including rice paddy. Gently sloping and steeper soils have erosion hazards. The establishment and maintenance of rice paddy systems becomes much more difficult as the slope of the land increases. Because of the importance of this factor the slope ranges of the soils have been incorporated in the name of the various mapping units.

2.2 Soil texture

Soil texture is a classification based upon grain size; that is the proportion of gravel, sand, silt, and clay as revealed by the mechanical analysis. Classes of soil texture are named, according to their mechanical composition, as sands, loams and clays. These terms are modified by objectives such as bouldery, stony, cobbly, or gravelly to indicate the presence of coarse fragments. Overall classes of texture are used to designate broad classes of dominant textures of the principal rooting zones of plants. These are used in the classification scheme to group similar soils at the family level. These groupings serve very useful purposes because, in addition to indicating general textures, they also indicate other important soil characteristics such as cation exchange and available moisture capacities. The soil tilth or ease of preparing seedbeds and cultivating crops depends upon the clay content. Sandy loams, loams, and silt loams free of coarse fragments can be tilled with the least effort. Clays, silty clays, and to a lesser extent clay loams and silty clay loams are too sticky and plastic, when moist, and too hard when dry to cultivate easily to prepare suitable seedbeds. Soils high in organic matter are also easier to till than soil with small amounts of this substance.

2.3 Organic matter content

The amount of organic matter in the surface horizons is indicated by colour. A dark colour indicates a high content of organic matter. The importance of organic matter is recognized at a high level in the classification scheme. The Mollisols and the Umbrepts have thick surfaces rich in organic matter. Soils of the Umbric, Mollic and Humic Subgroups of Dystrochrepts, Hapludalf, and Hapludult have thinner but darker surfaces rich in organic matter. Organic matter also increases the soil's ability to hold water and its cation exchange capacity. This is of particular importance in very sandy soils.

2.4 Depth

The depth of useful soil is a measure of the zone available for the roots of crops and plants. Some kinds of soil horizons limit the penetration of roots; for example a dense fragipan as in the Jangweon series or a hard rock as in the Daegu series. Many soils have horizons of much less useful soil under a horizon with desirable characteristics; for instance a very gravelly layer below a loamy horizon. While the gravelly layer contributes much less in terms of moisture and plant nutrients, it is still part of the soil depth if plant roots penetrate and use it for growth. Some soils such as Hwangyong are composed entirely of gravelly sand which is a poor medium for plant growth.

2.5 Available moisture capacity

The available moisture capacity of a soil is primarily determined by texture; mainly by the content of silt and very fine sand. It can be measured by measuring for each significant horizon the water held between one third and fifteen atmospheres of tension. Soils with very fine sandy loam, silt loam, and silty clay loam and classified in fine silty families are able to retain much moisture and are classified as high in this respect. Soils composed of sands without fines and classified in the sandy families will retain only small amounts of water and are classified as very low in available moisture capacity. Exceptions are the soils of the sandy families of Mollisols and Umbrepts in which the large amounts of organic matter and resulting improved physical condition make it possible for plants to obtain more water than in other sandy soils. Soils of the skeletal families have much lower capacities than soils composed mainly of silts and clays. Coarse fragments such as gravel occupy space in the soil but do not contribute to the available moisture capacity. A soil with 50 percent gravel will retain only 50 percent as much water as a soil of similar texture without gravel. High water tables in soils contribute to soil moisture and must be considered in determining the amount of water available to plants. This factor is a reflection of soil drainage rather than of available moisture capacity. This capacity is an important one in the design of non-paddy irrigation systems, as it represents the greatest amount of water that can be applied to change a dry soil to a fully moist one.

2.6 Soil fertility

The quality of a soil fertility depends on several soil characteristics that must be considered in relation to one another. Soil reaction, expressed as a pH value reflects the balance between exchangeable bases and acids. Calcium, magnesium, and potassium are bases required as fertility elements by plants. This balance is also measured as the base saturation and expressed as a percentage of the total bases as compared to the total amount of cations (bases, iron, aluminium, hydrogen etc.) the soil is able to absorb. This quality is known as the cation (or base) exchange capacity and is expressed as milliequivalents per 100 g of soils.

A high cation exchange capacity is a desirable characteristic in a soil because it helps to retain larger amounts of nutrients. Initially it may take a much larger amount of added fertilizers to raise the base status in a soil with high cation exchange capacity as compared to one with low cation exchange capacity. Once it is achieved the fertilizer requirement to maintain a high base status in both soils would not be much different at the same intensity of use. It may be pointed out that commonly soils with high cation exchange capacity have a much higher intensity of use because of their high potential for increased yields. Large amounts of fertilizer may be used more safely on soils with high exchange capacity because their large buffering capacity reduces the danger of inducing nutritional imbalance.

The importance of base saturation is recognized at high levels of classification. The Utisols with low base saturations are separated from the Alfisols with medium and high base saturations. Also Dystrochrepts and Umbrepts are separated from Eutrochrepts on this characteristic. One of the requirements of the Mollisol is a high base status.

The organic matter content is an indicator of the ability of the soil to supply nitrogen to the plants. Dark coloured soils high in organic matter such as Mollisols and Umbrepts will provide more nitrogen for plant growth than light coloured soils. However, after long time cropping all soils fail to provide optimum levels of nitrogen for most crops and this fertility element is provided in fertilizer in much larger amounts than the amount that is available in the soil.

Phosphorus has not been given a prominent part in soil mapping and classification; however some soils are known for their high content of this element. As the phosphorus is mainly inherited from the parent material a study of parent material will aid in determination of the general phosphorus level of soils. A long time study of soils and their responses to phosphatic fertilizer will enable soil scientists to make good predictions of response to phosphorus.

3. Interactions

Interactions among soil characteristics, soil qualities, the environment, and applied practices may produce desirable crop responses, such as a high yield of good quality; or undesirable ones, such as a crop failure because of drought or damage by insects. Every soil has a large number of separate but related characteristics; the environment has many characteristics and some of them (such as rainfall) vary from season to season; and the number of combinations of management practices is extremely large. Out of such virtually unlimited possibilities of interactions, useful soil interpretations are made by: (1) observing yields of crops on specific soils under defined workable levels of management; (2) studying the results in relation to the observed and measured soil characteristics and inferred soil qualities and (3) extending the results to predict performance of other similar or contrasting soils.

Chapter 6

MAKING USE OF SOIL SURVEYS

1. The Practical Applications of Soil Surveys

A soil survey gives basic information about soils. It describes and classifies the soils of the area concerned and shows the location and extent of each kind on a map.

The value of a soil survey is in its application to the practical use of the soil, whether for farming or some other purpose. In order to use the soil information to good advantage in making decisions, the landowner or operator must know what to expect from management practices on each kind of soil. This nearly always requires technical guidance.

It is not enough for a farmer to know that the soil of his field is in the Gimhae series. Nor is it sufficient to know that the soil is extremely acid and high in extractable aluminium, and contains iron sulphates. To make use of this information the farmer needs to know the effects of draining and leaching the soil, and applying lime.

Classification and mapping of soils must be done by specialists. These same technical specialists are best able to do much of the work needed to study the soils and their responses to management. This study should be continued and given increased emphasis in the work of the Korea soil survey.

In this section are brief discussions of some of the important interpretations that can be made of soil surveys. These include general land capability classes, paddy suitability groups, a table of general suitabilities for crops other than rice, and the application of soil surveys to engineering uses and physical land planning.

Soil survey interpretations are predictions of performance and response to management practices. They are not recommendations for the use of soils. The best way of using a soil depends on many considerations other than soil characteristics and responses. Economic, social, political, and other factors may have greater importance in determining the use of a particular tract of land than the kind of soil. Soil maps with applicable interpretations give the possible alternative uses and responses to management. With this information the owner or operator can choose the use that best suits his purposes.

2. Land Use Selection

A common use of soil surveys is in selection of land for development. In Korea, the entire country is populated and most of the areas of land that are naturally well suited to paddy are now being used.

Increase or change of paddy land areas is largely dependent on large scale irrigation programmes. A detailed soil survey provides information needed in determining the feasibility of irrigating new areas and of making adjustments in marginal areas now used for paddy.

Expansion of cultivated upland crops and of orchards, pasture and forage crops, mulberry and other special crops requires the careful selection of the best land available for the purpose. The soil survey identifies suitable areas and shows their extent and location. In upland areas such soil characteristics as slope, degree of erosion, stoniness and depth to hard rock can be determining factors in use, as well as texture, drainage and fertility. The soil survey shows these and other factors which a farmer must consider in deciding which areas of land should be developed, and which should be left in natural vegetation or planted to different species of trees.

3. Land Capability Classification

The land capability classification is a grouping of soils according to their general suitability for agricultural use (Klingebiel and Montgomery, 1961). Emphasis is put on the kind and degree of their permanent limitations for producing crops, pasture plants, trees and other useful vegetation. Eight general classes numbered I through VIII, representing the degree of limitations, and four subclasses representing the general nature of the problem are recognized.

The land capability classification is a broad general grouping of soils. It is useful to persons who want to appraise quickly the farming potential of soils in a large area; to provincial governors, gun chiefs, rural guidance directors, and other planners and administrators who are not interested in detailed information of soil but need to know the important limitations and the broad requirement for management for all the soils in order to plan intelligently for increased agricultural production. It must be remembered, however, that each kind of soil has a set of characteristics that makes it unique, and that precision of all characteristics is lost whenever different kinds of soils are grouped in order to make generalizations about them. The farmer who deals with a few kinds of soil or the agricultural adviser who counsels him needs to study not only the capability grouping, but also the characteristics, potentialities, and limitations of the particular mapping units. The classification expresses the number of possible broad uses of soil. For example, class I soils will produce several kinds of highly profitable grain crops, as well as pasture and woodland products. Some crops have requirements different from those of most other crops. Rice is an example needing soil that is much too wet to produce other important crops, or one that can be made wet by flooding. Soils classified with moderate to severe limitation of wetness (IIw and IIIw) for most crops are cropped to rice with fewer limitations than are class I soils. Because of this difference a separate grouping has been made showing suitability of soils for rice production.

The capability classification does not take into account the feasibility or the cost of drainage, or other works of improvement whose purpose is to permit the growing of a wide variety of crops. Some areas of wet soil can be drained by a short ditch. Other areas of the same mapping unit may lie so low in relation to a stream or tidal area that the only feasible way to obtain an outlet is to install pumps or other costly drainage devices. The mapping units do show important differences, however. Some soils by their nature have slower permeability rates than others and require more tile lines or more ditches per hectare for the same degree of drainage.

The capability subclass is indicated by adding a subclass symbol to the symbol used for the class. The subclass symbols are (e) for erosion hazards, (s) for soil hazard (limitation in available moisture capacity), (w) for a wetness or high water table limitation, and (wc) for wetness and unfavourable chemical composition of the soil (salts, extremely high acidity etc.). At the present time the capability subclass is synonymous with capability unit. The present status of information regarding the behaviour of soils under different management systems is not sufficiently detailed to warrant subdivision of the subclasses. As more information becomes available and soil management becomes more refined, it may be advisable to divide the subclasses into capability units, as is done in many other countries.

When a mapping unit is named it is placed in its correct capability class and subclass, and these are listed and defined in reports of individual soil survey areas. Land capability maps are made of any desired area by colouring or otherwise indicating the land capability classes and subclasses on a copy of the soil survey.

Not all mapping units recognized to date are listed in the grouping which follows. Instead, to save space, examples including one or more of the most important units of each soil series are listed. These serve to illustrate the system; if capability classification of specific units not shown is needed it may be obtained from legends or reports of individual gun areas.

CLASS I   Soils with few limitations that restrict their use

These soils will produce good yields of a wide variety of crops without special management practices.

Class I soils are adaptable for growing paddy rice, barley, wheat, soybeans, maize, and many other crops without any special practice to improve drainage, or protect the soil from erosion. Although good yields may be obtained without fertilizer, they may be increased by its use in most cases. Irrigation, nearly always used for rice, would greatly increase the yields of other crops also.

The soils of this group are nearly level, well or moderately well drained, moderately permeable, and have moderate or high available moisture capacities.

Example mapping units are:

Anmi loam, 0 to 2 percent slopes
Gyuam silt loam, 0 to 2 percent slopes
Hwadong silty clay loam, 0 to 2 percent slopes
Ihyeon silt loam, 0 to 2 percent slopes

CLASS II <u>Soils with moderate limitations that reduce the choice of plants or require special management practices</u>

Subclass IIe <u>Soils subject to moderate erosion if not protected by conservation practices or vegetation</u>

With the exception of a moderate erosion problem, Class IIe soils are much like Class I. While the building of rice paddies requires more grading than on the more level Class I soils, in all other respects they are well suited to growing paddy rice. They are also well suited for growing many kinds of grain and vegetable crops.

The soils of this group are the gently sloping (2 to 7 percent) well and moderately well drained, moderately to slowly permeable soils with moderate or high available moisture capacities.

Example mapping units are:

Baegsan loam, 2 to 7 percent slopes
Banho gravelly loam, 2 to 7 percent slopes
Chundo loam, 2 to 7 percent slopes
Gongseong silt loam, 2 to 7 percent slopes
Hwadong silty clay loam, 2 to 7 percent slopes
Sachon sandy loam, 2 to 7 percent slopes
Samam loam, 2 to 7 percent slopes
Wangsan silt loam, 2 to 7 percent slopes
Yongji loam, 2 to 7 percent slopes

Subclass IIs <u>Soils with moderate drought problems</u>

Class IIs soils have a moderate susceptibility to drought damage because of their low to moderate available moisture capacity. Crop yields are usually reduced and occasionally very low because of lack of soil water for optimum crop growth. Most crops would benefit from irrigation. Rice might be grown but large amounts of water may be needed because of the rapid permeability of these soils. Erosion is a hazard on the gently sloping to sloping soils of this group.

The soils of this group have low to moderate available moisture capacities, and are nearly level or gently sloping, well or moderately well drained, and rapidly to moderately permeable.

Example mapping units are:

Bonryang sandy loam, 0 to 2 percent slopes
Hogye gravelly loam, 0 to 2 percent slopes
Imog sandy loam, 2 to 7 percent slopes
Jungdong fine sandy loam, 0 to 2 percent slopes
Sangju fine gravelly sandy loam, 2 to 7 percent slopes
Seongsan sandy loam, 2 to 7 percent slopes
Tongcheon sandy loam, 0 to 2 percent slopes

Subclass IIw Soils with high water tables which limit the choice of crops unless drained

Class IIw soils are well suited to the production of rice because of their high water tables. They are too wet to grow most other crops without additional drainage. With a good system of drainage, all of the different kinds of crops that can be grown on Class I land may be grown. These may be grown in combination with rice or with other non-paddy crops. Though surface ditching is helpful in providing drainage, the installation of tile drains is the most effective method of drainage. Tile drains installed at normal depth and interval will lower the water table below the normal rooting depth.

The soils of this group are poorly or imperfectly drained, nearly level to gently sloping, and have moderate to high available moisture capacities.

Example mapping units are:

Baeggu silt loam, 2 to 7 percent slopes
Daldong silt loam, 0 to 1 percent slopes
Deogha silt loam, 0 to 1 percent slopes
Gangdong loam, 0 to 2 percent slopes
Geugrag silt loam, 0 to 2 percent slopes
Hagsan loam, 0 to 2 percent slopes
Hyocheon loam, 0 to 2 percent slopes
Jeonbug silt loam, 0 to 2 percent slopes
Jisan loam, 2 to 7 percent slopes
Mangyeong silt loam, 0 to 1 percent slopes
Sinheung loam, 0 to 2 percent slopes
Sugye silty clay loam, 0 to 2 percent slopes
Yeongsan loam, 0 to 2 percent slopes
Yuga silt loam, 2 to 7 percent slopes

CLASS III Soils with severe limitations in use that reduce the choice of plants or require special management practices or both

Subclass IIIe Soils subject to severe erosion if not protected by conservation practices or vegetation

These soils have a severe erosion hazard when regularly planted to annual non-paddy crops. Good yields of crops may be expected if erosion is controlled. Apple, pear, and peach orchards grow well but the soils are likely to wash severely unless care is taken to prevent it. They are suited for growing rice but the construction of rice paddies requires much grading. Because of the topography, paddies are usually small and irregular in shape. These irregular paddies require more labour to cultivate. Though erosion is insignificant within the paddies, care must be taken to prevent washing of the paddy levees. Small water control structures installed between paddies will lessen this erosion. Erosion is a severe problem in non-paddy crop areas. In these areas erosion is reduced when perennial crops are grown in combination with soil conservation practices such as terracing.

The soils of this group are mainly sloping (7-15 percent), well and moderately well drained, and have moderate to high available moisture capacities. Some gently sloping (2 to 7 percent) soils with moderate to low available moisture capacities, and some poorly and imperfectly drained, sloping (7-15 percent) soils are included in this subclass.

Example mapping units are:

Anyong cobbly loam, 7 to 15 percent slopes
Bancheon silty clay loam, 7 to 15 percent slopes
Banggi clay loam, 7 to 15 percent slopes
Changpyeong silty clay loam, 2 to 7 percent slopes, eroded
Gaghwa cobbly silty clay loam, 7 to 15 percent slopes
Iweon stony sandy loam, 7 to 15 percent slopes
Jeonnam silty clay loam, 7 to 15 percent slopes, eroded
Sirye silty clay loam,2 to 7 percent slopes, eroded

Subclass IIIs Soils with severe drought problems unless irrigated

Because of low available moisture capacity, few crops grow well on these soils without irrigation.

It is difficult to retain water on rice paddies because of rapid permeability. Crops that grow well on these soils without irrigation include melons, peanuts, onions, and cabbage. Apple, pear, and mulberry trees also produce good yields. Alfalfa and other deep-rooted crops would also produce satisfactory yields.

The soils of this group are nearly level, well or moderately well drained, rapidly permeable, and have low available moisture capacity.

Example mapping units are:

Myeongji loamy fine sand, 0 to 1 percent slopes
Nagdong loamy fine sandy, 0 to 2 percent slopes

Subclass IIIw <u>Soils with high water tables which limit the choice of plants unless drained</u>

Like the Class IIw soils, these soils also produce good crops of rice, but they are too wet to produce good yields of most other crops. Sufficient drainage for growing most other crops could be obtained by a combination of open ditch and tile drainage.

The soils in this group are mainly nearly level (0 to 2 percent), slowly permeable, and have moderate to high available moisture capacity. Some soils included have low available moisture capacity and would be somewhat droughty if drained. These are the moderately to rapidly permeable soils.

Example mapping units are:

Bongnam silty clay loam, 0 to 1 percent slopes
Buyong silty clay loam, 0 to 1 percent slopes
Gimje silty clay loam, 0 to 1 percent slopes
Gongdeog silty clay loam, 0 to 2 percent slopes
Honam silty clay loam, 0 to 2 percent slopes
Manseong loam, 0 to 2 percent slopes

Subclass IIIwc <u>Soils with high water tables and an unfavourable chemical nature which limits crop production</u>

The soils of this group are extremely acid, and have soluble salts, or have much sodium adsorbed on the cation exchange complex. They are also poorly or imperfectly drained. If the undesirable chemical nature of these soils were corrected by additions of lime and leaching with fresh water they would have characteristics favourable for high production.

Example mapping units are:

Bongrim silty clay loam, 0 to 1 percent slopes
Deunggu silt loam, 0 to 1 percent slopes
Deunggu silty clay loam, 0 to 1 percent slopes
Gimhae silty clay loam, 0 to 1 percent slopes
Gwanghwal silt loam, 0 to 2 percent slopes
Haecheog silt loam, 0 to 1 percent slopes

CLASS IV Soils with very severe limitations that restrict the choice of plants or require very careful management or both

Subclass IVe Soils with very severe erosion problems

The erosion hazard on these soils is too severe for growing annual crops regularly. However, when close growing hay and pasture crops cover the land, they reduce soil losses to negligible amounts. Some areas are planted to orchard or mulberry trees, but erosion is very difficult to control on the steep slopes. Rice paddies have been built on some of these soils. The paddies are usually small and irregular in shape, requiring much labour to produce a rice crop. The maintenance of the many paddy levees also requires much labour. A complex system of flood water drainage would reduce the work needed for maintenance of the paddy system.

The soils in this group are mainly moderately steep (15-30 percent), well drained, and have medium to high available moisture capacities. Other soils include gently sloping and sloping soils with low to medium available moisture capacities.

Example mapping units are:

Bonggye silty clay loam, 15 to 30 percent slopes, eroded
Buyeo rocky loam, 7 to 15 percent slopes
Chahang loam, 15 to 30 percent slopes
Cheongog silt loam, 15 to 30 percent slopes, eroded
Jangweon gravelly loam, 7 to 15 percent slopes
Mitan gravelly loam, 15 to 30 percent slopes
Mui stony loam, 15 to 30 percent slopes
Pyeongan cobbly clay loam, 15 to 30 percent slopes
Sinhyeon loam, 15 to 30 percent slopes, eroded
Sinjeong gravelly loam, 15 to 30 percent slopes, eroded
Ungyo cobbly silt loam, 15 to 30 percent slopes
Yuha silt loam, 15 to 30 percent slopes, eroded

Subclass IVs Soils with very severe moisture problems

These soils are so droughty that few crops will produce even moderate yields. Rice is grown on some of the Hwangyong soils. Because of their rapid permeability these soils need to be irrigated almost continuously. If limed and fertilized, moderate yields of alfalfa and other deep-rooted crops may be obtained. These soils are good for growing mulberry trees, and are used, to some extent, for pear and apple orchards.

The soils of this group have a very low available moisture capacity, and are well to excessively drained. Their principal textures are sand and loamy sand.

Example mapping units are:

Hwabong loamy sand, 0 to 2 percent slopes
Hwangyong gravelly sandy loam, 0 to 2 percent slopes
Ibseog loamy coarse sand, 2 to 7 percent slopes
Togye sandy loam, 2 to 7 percent slopes

Subclass IVw   Soils with severe drainage problems

Subclass IVw soils have a very severe waterlogging problem because of high water tables. They are difficult to drain as the sand tends to flow into the drainage channels. If drained they would be droughty.

The soils of this group are poorly drained, and have very low available moisture capacities. The principal texture of these soils below the surface layer is sand and loamy sand.

Example mapping unit is:

Sindab sandy loam, 0 to 2 percent slopes

CLASS V   Soils with little or no erosion hazard but with other limitations, impractical to remove, that limit their use to pasture or woodland

Class V land is of small extent in Korea, and areas which have been observed in mapping to date have not been correlated.

Many centuries of intensive labour have removed some limitations which elsewhere might be impractical to remove. Some areas naturally subject to frequent overflow by streams would be in Class V except for diking and paddy construction. Now they are placed in cultivable classes. Some unimproved areas of wetlands which would be placed in Class V have been observed in coastal sections, but not mapped in detailed surveys.

CLASS VI   Soils with severe limitations that make them generally unsuitable for cultivation and that limit their use to pasture or woodland

Subclass VIe   Soils with severe erosion problems

Because of steep slopes, soil depth, advanced erosion, rockiness, or stoniness these soils are so erodible that they are not suitable for cultivation. If properly treated and managed they are capable of producing low to moderate yields of pasture. However, much limestone and other fertilizers are required to obtain these yields. If not utilized as pasture they should be managed for woodland.

The soils of this group are dominantly steep (30-60 percent slopes), and have moderate to high available moisture capacities. Other soils included are rocky, stony, and bouldery phases of lesser slopes and some shallow soils with low available moisture capacities.

Example mapping units are:

Cheongsim stony silt loam, 30 to 60 percent slopes
Daegu rocky silt loam, 7 to 15 percent slopes, eroded
Habin rocky loam, 30 to 60 percent slopes, eroded
Jangseong rocky silt loam, 30 to 60 percent slopes
Mudeung rocky loam, 30 to 60 percent slopes, eroded

Pyeongchang rocky clay loam, 30 to 60 percent slopes
Samgag sandy loam, 30 to 60 percent slopes, eroded
Seogto stony loam, 15 to 30 percent slopes
Sinbul bouldery loam, 30 to 60 percent slopes
Taehwa loam, 30 to 60 percent slopes, eroded
Weoljeong sandy loam, 30 to 60 percent slopes

CLASS VII Soils with severe limitations that make them generally unsuitable for cultivation or pasture and limit their use to woodland

Subclass VIIe Soils with severe erosion problems

These soils are so rocky, steep, or badly eroded that they are suited only for the production of woodland products. The litter from the trees left on the soil surface will protect it from erosion. If this litter is removed annually, as done in many areas, the soil will erode rapidly.

The soils of this group are very steep, very rocky, severely eroded steep soils, gullied soils, or steep rocky soils with sandy or very gravelly textures.

Example mapping units are:

Gwanag rocky sandy loam, 30 to 60 percent slopes
Jeongja rocky loam, 30 to 60 percent slopes
Nagseo rocky loam, 30 to 60 percent slopes, eroded
Odae rocky loam, 60 to 100 percent slopes
Oesan stony loam, 30 to 60 percent slopes
Songjeong soils, 15 to 30 percent slopes, gullied

4. Paddy Suitability Groups

Rice is the most important crop in Korea. Because this crop grows well on soils that are too wet for the production of most crops (Classes IIw and IIIw), a special grouping has been made to classify the relative suitability of soils for rice. Some of the soils of Subclasses IIw and IIIw of the capability system are in group P1 for rice suitability because, for rice production, the high water table is a desirable characteristic, rather than a problem as it is with most crops.

The four limiting factors, with the small letters used as symbols for this grouping are: a - slope; b - permeability; c - height of water table, and d - chemical nature. These were evaluated into four general suitability groups: P1 very well suited, P2 well suited, P3 moderately suited and P4 poorly suited. Very steep, gullied, stony, or rocky soils are unsuitable for paddy and are not included in the classification.

(a) Slope is a very important characteristic in the evaluation of a soil for rice, as it affects paddy field size and shape. The nearly level soils can be graded into large rectangular paddies adaptable to mechanical planting and harvesting machinery. As slope increases the possibility of mechanization becomes progressively less, because paddy systems constructed on more sloping areas have smaller paddy fields with irregular shapes, and greater vertical intervals between them. Even with the common methods of preparing land with oxen, and transplanting and reaping by hand, the small irregular paddy fields on the moderately steep slopes of the hilly areas require more time and effort than the large regular fields of the level plains. Increased slope with increased vertical distance between fields also permits greater losses of irrigation water.

(b) Rapid or moderate permeability are unfavourable characteristics because they permit high water losses and thus require larger quantities of irrigation water to maintain the desired depth of water in the rice paddies. Associated with this high water loss are high leaching losses of plant nutrients and low available moisture capacities. Low available moisture capacity is not a limitation to rice production if sufficient irrigation water is available. There are many such areas in Korea.

(c) The height of the water table is important because of its influence upon water consumption. Small amounts of water are needed for poorly or imperfectly drained soil as the high water table retards losses of water. On the other hand well drained soils with low water tables require more water to maintain the desired depth in the paddy. For the more permeable soils this is a very important factor, but for the slowly permeable soils it is a much less important factor, as water losses are low.

(d) Adverse chemical nature is an important factor in some areas and limits the possible yield, or requires much input of fertilizer, lime, or other soil amendments. Some soils recently reclaimed from the sea have high salt contents, others have developed extremely high acidity following drainage, and other soils have a low cation exchange capacity which limits the soil's ability to store plant nutrients from one season to the next.

P1 VERY WELL SUITED:

Land that is suitable for rice without the necessity for special development or management practices and without special limitations or hazards

Nearly level (0 to 2 percent), moderately and slowly permeable soils with high water tables.

Bongnam silty clay loam, 0 to 1 percent slopes
Buyong silty clay loam, 0 to 1 percent slopes
Daldong silt loam, 0 to 1 percent slopes
Geugrag silt loam, 0 to 2 percent slopes
Gimje silty clay loam, 0 to 1 percent slopes
Gongdeog silty clay loam, 0 to 2 percent slopes
Hagseong silt loam, 0 to 1 percent slopes
Honam silty clay loam, 0 to 2 percent slopes
Hyocheon loam, 0 to 2 percent slopes
Mangyeong silt loam, 0 to 1 percent slopes
Sinheung loam, 0 to 2 percent slopes

<u>P2</u> <u>WELL SUITED:</u>

<u>Land that is suitable for paddy with the application of simple special development and management practices and with moderate hazards and limitations for use as rice paddy</u>

P2a <u>Soils with a limitation of slope</u>

Gently sloping (2 to 7 percent slopes), moderate and slowly permeable soils with high water tables.

Baeggu silt loam, 2 to 7 percent slopes
Jisan loam, 2 to 7 percent slopes
Yuga silt loam, 2 to 7 percent slopes

P2ao <u>Soils with limitations of slope and high water requirement</u>

Gently sloping (2 to 7 percent slopes), well drained moderately to slowly permeable soils with medium and heavy textures.

Baegsan loam, 2 to 7 percent slopes
Banho gravelly loam, 2 to 7 percent slopes
Changpyeong silty clay loam, 2 to 7 percent slopes, eroded
Chundo loam, 2 to 7 percent slopes
Gongseong silt loam, 2 to 7 percent slopes
Hwadong silty clay loam, 2 to 7 percent slopes
Jangweon gravelly loam, 2 to 7 percent slopes
Jangyu silty clay loam, 2 to 7 percent slopes
Samam silt loam, 2 to 7 percent slopes
Sirye silty clay loam, 2 to 7 percent slopes, eroded
Wangsan silt loam, 2 to 7 percent slopes
Yongji loam, 2 to 7 percent slopes

P2b <u>Soils with limitation of low available moisture capacities and rapid permeability</u>

Nearly level (0 to 2 percent slopes), loamy soils over sand with high water tables.

Hagsan loam, 0 to 2 percent slopes
Manseong loam, 0 to 2 percent slopes
Sadu fine sandy loam, 0 to 1 percent slopes
Seoggye fine sandy loam, 0 to 2 percent slopes

P2c <u>Soils with limiting characteristics of high water requirement</u>

Nearly level (0 to 2 percent slopes), well and moderately well drained, moderately permeable soils. These soils have medium textures.

Anmi loam, 0 to 2 percent slopes
Gyuam silt loam, 0 to 2 percent slopes
Ihyeon silt loam, 0 to 2 percent slopes

P3 MODERATELY SUITED:

Land that is suitable for paddy with the application of difficult special development and management practices, and with severe hazards and limitations for use as rice paddy

P3a Soils with a limitation of slope

Sloping (7 to 15 percent slopes), moderately and moderately slowly permeable soils with high water tables.

Jisan loam, 7 to 15 percent slopes

P3ac Soils with limitations of slop^ and high water requirement

Sloping (7 to 15 percent slopes), moderately to moderately slowly permeable loamy to clayey soils with low or no water tables.

Anyong cobbly loam, 7 to 15 percent slopes
Bancheon silty clay loam, 7 to 15 percent slopes, eroded
Banggi clay loam, 7 to 15 percent slopes
Gaghwa cobbly silty clay loam, 7 to 15 percent slopes
Jangweon gravelly loam, 7 to 15 percent slopes
Jeonnam silty clay loam, 7 to 15 percent slopes, eroded

P3b Soils with limitations of low available moisture capacities and rapid permeabilities

Nearly level (0 to 2 percent slopes), rapidly permeable, sandy soils with low available moisture capacities and high water tables.

Hamchang silt loam, 0 to 2 percent slopes
Sindab sandy loam, 0 to 2 percent slopes

P3c Soils with the limitation of high water requirement

Nearly level (0 to 2 percent slopes), well drained, moderately to moderately rapidly permeable soils with high or moderate available moisture capacities.

Hogye gravelly loam, 0 to 2 percent slopes
Maji gravelly loam, 0 to 2 percent slopes
Tongcheon sandy loam, 0 to 2 percent slopes

P3d <u>Soils with limiting characteristics related to their chemical nature</u>

Nearly level (0 to 2 percent slopes), extremely acid, high sodium or saline, poorly or imperfectly drained, moderately to slowly permeable soils.

Bongrim silty clay loam, 0 to 1 percent slopes
Deunggu silty clay loam, 0 to 1 percent slopes
Gimhae silty clay loam, 0 to 1 percent slopes
Gwanghwal silt loam, 0 to 1 percent slopes
Haecheog silt loam, 0 to 1 percent slopes

<u>P4</u> <u>POORLY SUITED:</u>

<u>Land that is of limited or questionable suitability for paddy because of very severe hazards and limitations and the need for very difficult special management practices for use as rice paddy</u>

P4a <u>Soils with limitations of slope</u>

Moderately steep (15 to 30 percent slopes), poorly and imperfectly drained moderately to rapidly permeable soil.

Jisan loam, 15 to 30 percent slopes
Subug sandy loam, 15 to 30 percent slopes

P4abc <u>Soils with limitations of slope, high water requirements, and moderate available moisture capacities</u>

Gently sloping to moderately steep (2 to 30 percent slopes), well drained, moderately to moderately rapidly permeable soils with moderate to low available moisture capacities.

Ibseog loamy coarse sand, 2 to 7 percent slopes
Imog sandy loam, 2 to 7 percent slopes
Iweon stony sandy loam, 7 to 15 percent slopes
Maji gravelly loam, 2 to 7 percent slopes
Mitan gravelly loam, 15 to 30 percent slopes
Mui stony loam, 15 to 30 percent slopes
Sangju sandy loam, 2 to 7 percent slopes
Seongsan sandy loam, 2 to 7 percent slopes
Togye loamy coarse sand, 2 to 7 percent slopes

P4ac <u>Soils with limitations of slope and high water requirements</u>

Moderately steep (15 to 30 percent slopes), well drained, moderately to moderately slowly permeable soils.

Bonggye silty clay loam, 15 to 30 percent slopes, eroded
Chahang loam, 15 to 30 percent slopes
Pyeongan cobbly clay loam, 15 to 30 percent slopes
Sinhyeon loam, 15 to 30 percent slopes, eroded
Sinjeong silt loam, 15 to 30 percent slopes, eroded
Songjeong loam, 15 to 30 percent slopes, eroded
Ungyo cobbly silt loam, 15 to 30 percent slopes
Yuha silt loam, 15 to 30 percent slopes, eroded

P4bc <u>Soils with limitations of low available moisture capacities and high water requirements</u>

Nearly level (0 to 2 percent slopes), well drained, rapidly permeable soils with very low available moisture capacities.

Bonryang sandy loam, 0 to 2 percent slopes
Hwabong loamy sand, 0 to 2 percent slopes
Hwangryong gravelly loamy sand, 0 to 2 percent slopes
Jungdong fine sandy loam, 0 to 2 percent slopes
Myeongji loamy fine sand, 0 to 1 percent slopes
Nagdong loamy fine sand, 0 to 2 percent slopes

5. Suitability Ratings for Crops Other Than Rice

The ratings, which are presented in Table 4 below, are based on yields obtained in experiment plots together with field observation of growth and general appearance of crops growing on a particular soil. Experimental plot yields and growth observation of similar soils are also considered.

For simplification the ratings are made for the soil series without reference to the mapping unit. For series having mapping units of different slope and erosion phases, the rating is for the most suitable. Other mapping units of the same series vary correspondingly in suitability.

In making these ratings, the following assumptions and guides were used, and should be kept in mind when using them.

It is assumed that crops will be grown with a high level of management that can be obtained by most farmers; that lime and fertilizers will be used according to soil tests and the needs of the crop; that runoff and erosion will be controlled if the land is subject to erosion; that the water tables are controlled to the optimum levels for the crop; that fields used for barley and other crops grown after rice are drained sufficiently for a good seedbed to be prepared and that plant growth will not be retarded by lack of aeration; that drainage systems lower the water table effectively to at least 80 cm on poorly and imperfectly drained soils. Limitations due to coarse fragments, slope, and severe erosion are not evaluated in the ratings, as many series have a range in these characteristics.

Effects of climate are not always reflected in the ratings, as some soils are mapped in the north as well as in the south of the country and climatic differences may be great enough to affect crop growth. The Songjeong soils, for example, are mapped in Gimhae Gun on the south coast, as well as in Pyeongchang Gun in the higher elevations. This covers the wide climatic range of Korea, except for the higher elevations of Pyeongchang and other northern guns 1/. Tobacco, sesame, and cotton are grown on Songjeong soils in the Gimhae Gun, but are not adapted to Pyeongchang Gun, mainly because of the lower temperatures and the shorter growing season. White potatoes are well adapted to the Songjeong soils of the Pyeongchang Gun because of the more suitable climate, but less well adapted in Gimhae Gun.

The adaptation is based on the presently known levels of agricultural technology and the presently available crop varieties. As technology advances and new crop varieties are made available, the ratings may need to be changed.

The ratings were made for many soil series that have been studied and exactly defined for only a short time. Undoubtedly some of the ratings will need to be revised as more observations are made. Because of this limitation the table should be regarded as an approximation, to serve as a guide in obtaining more detailed and more accurate information.

The ratings are based upon economic return as well as on plant growth, as this return is a simple means of classifying adaptability. The changing economic situation may alter the ratings.

The list of crops covers only those that are common for commercial production. Four levels of suitability are recognized in the table. Omissions from the list indicate not a lack of suitability but a lack of information.

(1) Well suited

The soil has almost ideal physical and chemical characteristics for the crop. Economic returns are particularly high. In most cases, the soil is mainly planted to the crop or much of the total crop is produced on this soil. An example might be onions on the soils of the Myeongji soils in Gimhae Gun. A large portion of this very sandy soil is planted to this crop because it produces high yields of high quality onions.

(2) Moderately suited

Plant growth is good and the economic return is sufficiently high to make it profitable to grow the crop most years. The soil may have only moderately favourable physical and chemical characteristics for the crop.

1/ Districts (Korean).

Table 4

CROP SUITABILITY RATINGS FOR THE SOIL SERIES

Series Name	Alfalfa (1)	Apple (2)	Barley (3)	Flax (4)	Hemp (5)	Ladino Clover (6)	Mulberry	Parsley (7)	Peach (8)	Peanut (9)	Radish (10)	Soybean (11)	Sweet Potato	Tobacco (12)	White Potato
Anmi	1	1	1	1	1	1	1	4		2	1	1	1		1
Anyong	2	2	2	3	2	2	1	4	1	3	3		2	1	3
Baeggu	4	4	4	3	4	4	3	1	4	4	4	3	4	4	4
Baegsan	1	1	1	1	1	1	1	3	1	2	2	1	1	1	1
Bancheon	2	2	2	3	2	2	2	4	1	3	3	2	2	2	2
Banggi	2	2	2	3	2	3		4	2	4	4	2	4		4
Banho	2	2	1	2	2	1	1	4	1	3	3	1	1	1	2
Bansan	1	1	1	1	1	1	1	3	1	2	2	1	1	1	1
Bonggye	2	3	3	2	2	2	1	4	2	4	4	3	3	2	
Bonryang	1	2	2	2	2	2	1	3	2	1	1	3	2	1	1
Bongrim	4	4	4	2	4	3	3	1	4	4	4	2	4	4	3
Bongnam	3	4	3	2	4	2	3	1	4	4	4	2	4	4	3
Buyeo	2		2	3	2	3	2	4	3	4	4	3	3	3	
Buyong	3	4	3	2	4	2	2	2	4	4	4	2	4		3
Changdong		4	4				3				4		4	4	4
Chahang	2		2	2	1	3	1	4			1		3	4	1
Changpyeong	2	2	2	3	2	3	2	4	1	3	3	2	2	2	2
Cheongog	2		3	3	2	3	2	4	2	3	4	2	2		3
Cheongsim	3	4	4	4	4	3	3	4	4	4	4	4	4	4	4
Chundo	2	3	2	2	3	1		3	3	3	3	1	3	3	2
Daegu	4	4	4	4	4	4	3	4	3	4	4	4	4	4	4
Daeyang	1	2	2			2	1		2	1	1	3	2	1	1
Dalcheon	2		1	3	2	2	1	4	2		3	2	1	2	3
Daldong	3	3	2	2	4	2	2	2	3	3		2	3	3	2
Deogha	3		3	2	3	2	2	2		4	4	2	4		3
Deunggu	4		3				2			4	4	4	4		3
Gaghwa	2	2	1	3	2	2	1	4	1	3	3	2	2	1	3
Gangdong	4	4	4	3	4	3	3	1		4	4	3	4	4	4
Geugrag	2		2	1	2	2	2	2			4		3	3	3
Gimhae															
Gimje	3	4	3	2	3	2	3	2	4	4	3	4	4	3	3
Gongdeog	3	4	3	2	4	3	3	1	4	4	4	2	4	4	3
Gongseong	2	2	2	3	2	2	2	4	1	3	3	1	2	2	2
Gwanghwal	3	4	3	3	4	3	4	1	4	4	4	3	4	4	4
Gwanag	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Gwangju	2	2	2	3	2	2	1	4	1	3	3	1	2		3
Gwangsan	2	2	2	3	2	2	1	4	1	3	3	1	2		3

Other crops with similar suitability: (1) Brome grass, timothy, (2) Pear, (3) Wheat, (4) Rape, (5) Ramie, (6) Orchard grass, alsike clover, tall fescue, rye grass, (7) Rush, (8) Grapes, (9) Red bean, melon, cowpea, (10) Cabbage, turnip, (11) Corn, sorghum, sudan grass, (12) Red pepper, millet, sesame, perilla, vetches.

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Table 4 (Cont'd)

Series Name	Alfalfa (1)	Apple (2)	Barley (3)	Flax (4)	Hemp (5)	Ladino Clover (6)	Mulberry	Parsley (7)	Peach (8)	Peanut (9)	Radish (10)	Soybean (11)	Sweet Potato	Tobacco (12)	White Potato
Gyuam	1		1	1	1	1	1	4	2	2	1	1	2	2	1
Habin	4	4	4	4	4	4	3	4	3	4	4	4	4	4	4
Haecheog															
Hagsan	1	1	2	1	2	1	1	3	2	2	2	1	2	2	1
Hagseong	3	4	4	3	4	3		1	4	4	4	3	4	4	4
Hamchang	4	4	4	3	4	3	4	1	4	4	4	3	4	4	4
Hogye	1	2	2	2	1	1	1	4	1	1	1	2	1	1	1
Honam	3	4	3	2	3	2	2	2	4	4	3	2	3	4	3
Hwabong	2	2	4	4	3	4	1	4	4	1	3	4		2	
Hwadong	2	2	1	1	2	1	2	3	1	3	3	1	2	2	2
Hwangyong	2	3	3	4	3	4	1	4	2	1	2	3	3	1	2
Hyocheon	3	4	3	2	3	2	2	2	4	4	3	2	3	4	3
Ibseog	4	2	4	4	3	4	1	4	2	1	2	3	3	1	2
Ihyeon	1	1	1	1	1	1	1	4		2	1	1	1	1	1
Imog	1		2	2	1	1	1	4		3	1				1
Iweon	2		3	3	1	2	1	4	2	2	2	3	3	1	2
Jangseong	4	4	4	4	4	2	4	4	4	4	4	4	4	4	4
Jangweon	3	3	3	2	3	2	2	4	3			3		1	
Jeonbug	3	3	2	1	3	2	2	2	3	3	3	2	3	3	2
Jeongja	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4
Jeonnam	2	2	2	3	2	2	1	4	1	3	2	1	2	2	3
Jingog	2	2	2	3	2	2	1	4	1	3	2	1	2	2	3
Jisan	3	4	3	1	3	2	2	2	4	4	3	2	3	4	3
Jungdong	1	1	2	3	2	1	1	4	2	1	1	3	2	1	1
Mangsil	3	4	4			2	1			4	1	4	3	4	1
Maji	1		2	2	1	1	1	4	2	4	1	2	1	1	1
Mangyeong	3	3	2	1	3	2	2	2	4	3	3	2	3	3	2
Manseong	3	3	2	1	3	2	2	1	4	3	3	2	3	3	2
Mitan	1		3	2	1	2	1	4	3	4	4	3	3	1	3
Mudeung	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4
Myeongji	1	2	3	3	2	3	1		2	1	1	2	2		1
Nagdong	1	1	3	3	2	3	1	4	2	1	1	2	3		2
Odae	3	4	4	4	4	2	3	4	4	4	3	4	4	4	3
Oesan	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Pyeongan	2	2	2	3	2	2	1	4	1	3	3		2	1	3
Pyeongchang	1	4	2	3	2	1	1	4	3	4	4	3	2	3	3
Sadu	3	2	3	1	2	2	1	3	2	1	1	2	2		1
Sachon	1	2	2	1	2	1	1	2	3	2	2		2	1	1
Samam	2	3	2	1	2	1	2		3	3	3	1	3		2
Samgag	2	4	3	4	3	4	2	4	3		4	3	3	2	
Sangju	1	2	2	2	1	2	1	4	1	1	1	2	2	1	
Seongsan	1	2	1	2	1	2	1	4	1	1	1	2	2	1	
Seoggye	2	3	2	1	2	1	2	1	3	3	2	1	2	3	2
Seogto	2		3	4	3	3	1	4	3	4	4	3	3	1	3

.../...

Table 4 (Cont'd)

Series Name	Alfalfa (1)	Apple (2)	Barley (3)	Flax (4)	Hemp (5)	Ladino Clover (6)	Mulberry	Parsley (7)	Peach (8)	Peanut (9)	Radish (10)	Soybean (11)	Sweet Potato	Tobacco (12)	White Potato
Sinbul	2	4	4			3	1		4	4	4	4	3	2	3
Sindab	4	4	4	3	4	3	4	1	4	4	4	4	4	4	4
Sinheung	2	3	2	1	2	1	2	2	3	3	3	2	3	3	2
Sinhyeon	1		4	1	2	2		4		4	4	3	3	3	4
Sinjeong	2	3	3	3	2	2	1	4	2	4	4	3	3	2	4
Sirye	2		1	3	2	2	1	4	2	3	4	3	2	2	4
Songjeong	2	2	2	2	1	2	1	4	1	3	3	2	1	1	2
Subug	2	4	3	2	3	2	3	1	4	3	3	2	3	4	3
Sugye	4	4	4	3	4	3	3	1	4	4	4	3	4	4	4
Taehwa	2		4	2	1	3	1	4	1	4	4	3	3	2	3
Togye	2	2	3	4	3	4	1	4	2	1	3	3	3	1	3
Tongcheon	1	2	2	1	2	1	1	2	2	2	2		2	3	2
Ungyo	1	4	3			1	1		4	4	2	2	3	3	2
Wangsan	2	4	1	3	2	1	1	4	4	4	2	3		4	2
Weoljeong	3	4	4				2		4	4	3	4		4	3
Yeongsan	3	4	2	1	3	2	3	2	4	3	3	2	3	4	3
Yongji	2	3	2	1	2	1	2	3	3	3	3	2	3	3	2
Yuga	2		3	1	2	2	2	3		3	3	2	3	4	3
Yuha															

(3) Poorly suited

While the crop may grow on the soil the requirements of the crops are sufficiently different from the characteristics of the soil to permit only low economic return in most years. Test plantings made with crops on soils with this rating will give a good indication of possible yields.

(4) Not suited

The crops are so poorly suited to the soil that little plant growth can be expected. Economic return can be expected in only one year out of five or ten.

6. Woodland Suitability

Woodland is an important land use in Korea. Forest lands comprise approximately two thirds of the country's total area and offer good potential for increased economic production.

The soil characteristics which affect site quality need further study. Such characteristics and qualities as depth, texture, permeability, watersupplying capacity, drainage and natural fertility to a large extent determine species adaptation and productivity. The local environmental factors of aspect and position on the slope are also important. Slope gradient, stoniness and rockiness affect forest management and use of equipment.

Although information is lacking for specific interpretations of the soil maps for woodland use, it is possible to make interpretations which apply generally. Shallow soils of low watersupplying capacity have different adaptation and lower productivity than deeper soils of high watersupplying capacity. Trees on soils with a high water table, or on shallow soils over hard rock, are subject to greater damage from windthrow than trees on soils with a deeper rooting zone. Difficulties of tending the forest and harvesting the crop are greater in areas of steep, rocky soils. Soil erosion is a severe problem in all woodland areas except those that are remote from villages, because of removal of soil surface cover. Eroded and gullied areas have reduced soil fertility and watersupplying capacity, and are difficult to re-establish in productive forest. Differences in natural fertility are reflected in growth rates. These and other soil characteristics influence forest production.

Soils have been placed experimentally in woodland suitability groups in the Pyeongchang Gun. Investigation of the relation of the mapped soil types to forest productivity is under way in the same area in cooperation with the UNDP/FAO Forest Survey and Development Project 1/. Similar studies should be made in cooperation

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1/ Operational from November 1964 to November 1968. Executed by FAO.

with forest management agencies throughout the country. Soil survey interpretation officers should continue efforts to establish the relationship between trees and soils, in order to make full use of soil maps in forest areas.

7. Applications of Soil Surveys to Engineering and Physical Land-Use Planning

7.1 General

Soil surveys when properly interpreted have recently been profitably used by nonagriculturalists such as engineers, builders, planners etc. Experience has shown that their application to the planning of individual structures or large community developments, and to regional planning has resulted in considerable saving in construction costs. Many structures have failed because the soils on which they were built were not suitable for the purpose. A better understanding of the physical and chemical behaviour of soils has helped to explain such failures. A soil map classifies the soils on the basis of similar morphological, physical and chemical characteristics.

The increase in population proportionately increases the pressure on land for housing and food. In many ways the desirable soil characteristics for plant growth and for engineering use are similar. Therefore the competition between engineering and agricultural uses for land is very keen. The priorities therefore should be clearly fixed and the land used accordingly. This can be accomplished by interpretation of soil survey information by experienced technical personnel. Good information is now provided in this country by the soil survey and a team of soil scientists have been trained to initiate a programme of interpretations for various uses.

Engineering limitations are given at the series level and would apply to all the mapping units in a series except for the inclusions (soils which otherwise belong to another series but, owing to small extent, are included in the unit mapped in a particular delineated area). The limitations of each series are normally categorized into slight, moderate and severe or other similar expressions. This discussion, however, lists only the severe limitations of series for engineering uses. Where possible the categorized limitations are given in the detailed soil survey reports of individual guns. This section is a generalization of the data presented in those reports.

7.2 Soil limitations for engineering

7.2.1 Depth to bedrock. The soil series and the mapping unit descriptions give an estimate of soil depth to bedrock. Soil depth determines many engineering uses for soils. The laying out of a new highway route with the help of a soils map in the planning stage can help avoid places where cuts must be made through hard rock. Problem areas underlain by clayey and shaly materials, susceptible to landslides in wet weather, may be avoided. Utility companies may be able to avoid placing pipelines or wooden poles in shallow soils underlain by hard rocks. Such soils have low permeability rates and are unsuitable for septic tanks. Housing lots should therefore be small enough to minimize the cost of sewage lines and other soil related utilities. Shallow soil depth over hard bedrock is suitable for heavy structure foundations such as multistorey apartment buildings, bridges, etc., but the landslide and saturated flow hazards on hillsides should be studied carefully before construction. Some of the soils with shallow depth over hard bedrock are listed below:

Habin	Gwanag	Jangseong
Daegu	Jeongja	Nagseo
Mudeung	Odae	

Some other soils with clayey or soft bedrock and susceptible to landslide hazards are as follows:

Songjeong	Sirye	Oesan
Jeonnam	Samgag	Gwangsan

7.2.2 <u>Seasonal high water table</u>. Seasonal high water table in soils is a potential hazard to the engineering uses. The nearness of the water table to the surface can result in failure of septic tanks and flooding of basements in residential localities. It is also a potential hazard to highways and foundations of heavy structures, owing to saturated flow. The soils listed below have restricted engineering use because of seasonal high water table:

Baeggu	Gimje	Mangyeong
Bongnam	Gyuam	Manseong
Bongrim	Hagseong	Seoggye
Buyong	Hamchang	Sinheung
Daldong	Honam	Subug
Deunggu	Hyocheon	Sugye
Gangdong	Jisan	Yeongsan
Gimhae	Jeonbug	Yuga

In cold climate moist soils are susceptible to frost heave. Frost heave is a potential hazard to structures such as highways constructed on these soils. Some of the soils susceptible to frost heave are listed below:

Bancheon	Gongseong	Pyeongan
Bonggye	Hwadong	Pyeongchang
Changpyeong	Gwangju	Sinhyeon
Cheongog	Ihyeon	Sirye
Dalcheon	Jingog	Yuha
Gaghwa	Jeonnam	Mangsil

7.2.3 Particle size distribution. The soil survey report accompanying a soil map gives the engineering soil classification of each soil series. With this information soil maps can be very profitably used for materials inventory of a general area. The location of gravel pits and sites for suitable borrow materials requiring minimum hauling can result in considerable reduction in highway construction costs.

The general suitability of a soil as highway subgrade can be determined. This information helps to estimate the amount of borrow material needed to grade a highway through an area and to find the places where subgrade materials should be removed and replaced, such as areas with unsuitable micaceous or clayey soils. Soil maps can be very profitably used for soil-cement construction of base courses of highways, streets and airports. Once the cement requirement of a particular soil series is determined, the same results can be used wherever that soil occurs. It is hoped that such tests will be conducted for each important soil series in Korea and the information used. It may be pointed out that the prospects for soil-cement construction are good in this country.

7.2.4 Permeability. Permeability relates to movement of water through undisturbed soil. Low permeability is a desirable characteristic for farm pond reservoirs and sewage lagoons, because it helps to impound water. The same property, however, restricts the engineering use of such soils for the foundations of low buildings, for highway subgrade and for roadfills. Low permeability of a soil also limits its use for septic tank filter fields because effluent will be slow to pass through the soil. The soil series descriptions and the mapping units give the permeability rating of the soils. This information has in some cases proved exceptionally useful where the soils have a pan or hard layer near the surface which restricts their use for septic tank filter fields. Shattering the hard layer of these soils would make them suitable for this purpose. Some of the important soil series with low permeabilities are listed below:

Jangweon	Gongseong	Cheondo
Gongseong	Changpyeong	Geugrag
Bancheon	Gwangju	Pyeongchang
Hwadong	Gwangsan	Sirye
		Ungyo

There are not many soils with hard pans in this country. Some soils which may pose problems because of the presence of hard pans are listed below:

Jangweon	Gwangju
Gongseong	Jingog
Changpyeong	

7.2.5 Shrink-swell potential. Soils with high shrink-swell potential are unsuitable as highway subgrades and as foundations for high structures because they are likely to move enough to crack foundations and walls. They may tilt trees or utility poles and break pipelines. A soil map shows the places where trouble is likely to occur. It may be pointed out that the extent of soils with high shrink-swell potential is very limited in Korea and they occur mainly in the Pohang area. These soils have not yet been mapped in detail.

7.2.6 Corrosivity. Metal or concrete pipes buried in soils corrode at different rates. The rate of corrosion differs with soil characteristics, mainly pH and salt content. The metal pipes are affected more by the pH and oxidation-reduction reactions, whereas concrete pipes are affected more by the content of salts, and particularly by the sulphate content. The nature of the soils in an area may help determine the type of pipes required. A special cement can be used in concrete pipes to be installed in salt-affected areas. A soil map is helpful in determining such needs. Salty soils are quite common in the coastal flats of Korea. Some of the soils are corrosive to metal and some others cause deterioration of concrete pipes, as listed below:

Soils corrosive to metal pipes		Soils causing deterioration of concrete	
Buyong	Jangseong	Bongrim	Myeongji
Daldong	Jeonbug	Gimhae	
Deogha	Mangyeong	Deunggu	
Gwanghwal	Maryeong	Gongdeog	
Hyocheon	Yuga	Haecheog	

7.3 Application of soils information at the planning stage

For appraisal and interpretation of soils at particular sites, the mapping unit and series are first found on the soil map and then referred to the engineering characteristics and predicted use limitations for that series. It should be emphasized however that the soil maps are somewhat general and do not eliminate the need for investigation of specific building sites and testing of the soil material. In making use of a soil map for regional physical planning, each soil series within the region or project area is evaluated and used according to its predicted responses and land-use recommendations. Residential, industrial and recreational areas are laid out on the basis of such predicted land use. Utility lines and roads can be planned more economically and scientifically with the help of a soil map. In overall regional planning the highly productive agricultural land can be saved until its urban use is absolutely necessary. Areas with potential natural hazards such as floods, landslides etc. can be barred from residential uses by framing property or zoning laws.

Chapter 7

SOIL MANAGEMENT

1. Drainage and Irrigation

The drainage class noted in soil descriptions is not a continuing limitation, as soil drainage can be changed by management. Well drained soils can be kept wet by building paddy systems and surface water can be removed or a high water table lowered by digging drainage ditches and installing tile drainage. Many of the most highly productive soils of the world were once wet but have been drained and are growing a wide variety of high profit crops. It is possible to drain a number of soils of Classes IIw, IIIw, and IIIwo now producing only rice, and grow winter crops such as barley and wheat in addition. Levee systems have been constructed for protection of land from flooding both by rivers and tides. Further expansion of agricultural land by this means is possible in many areas.

Flood irrigation of rice paddies is a common practice and is used on all paddies for which sufficient water can be obtained. The suitability of soils for this use is discussed in the section on paddy suitability groups.

The limiting factor in developing land for rice paddy is the availability of water, not the soils. Greater efficiency in managing the water available now could increase the area in paddy to some extent, as could development of new sources by pumping from wells, streams, and reservoirs.

Irrigation of crops other than rice offers possibilities of increased production. Fruit and vegetable crop yields could be improved in many places by irrigating with water supplies not now fully utilized.

2. Soil Erosion

Soil erosion is very severe on the woodlands and cultivated uplands of Korea. It is a main cause of low production in forests and upland crops. Erosion effects are cumulative, and become progressively more difficult to overcome. They include loss of organic matter and depletion of natural fertility, reduced rooting zone, lowered storage capacity for water and plant nutrients, filling of stream channels and destruction of paddies by coarse sediments.

The washing of the upland soil areas is a limiting factor affecting the expansion of the agricultural land. Much land which is now producing little could be made more productive, but erosion control measures are needed before other management inputs can be used efficiently. With the exception of some bench terraces 1/ there has been little application of erosion control practices in areas that are regularly cropped. Cultivated uplands are almost entirely planted to annual crops, mostly in rows. Soil erosion losses are very high with this system. Perennial close growing crops such as forage crops, which protect the soil from erosion, have been grown only on small areas; however, the recent emphasis on livestock production may increase the demand for these crops.

The erosion problems of cultivated lands are closely related to their fertility level. Soils with low fertility levels that produce only meagre plant growth erode rapidly. The erosion removes much of the fertility and leaves a soil even more infertile, capable of producing crops of little economic value.

Cultivation by present practices, including ploughing with oxen, or by hand in small fields, is possible, even though the erosion hazard is severe in many places. If land holdings and fields are enlarged and more machinery is used it will be necessary to use new practices. Cropping systems giving more emphasis to forage crops, and conservation practices such as contour tillage, graded and bench terraces, strip cropping, and grassed waterways will permit the maximum use of land with the minimum of soil loss. Agricultural officers are needed to guide the farmers in the selection of crops and farming systems so that the soils will be maintained and improved, and not allowed to wash away.

Erosion in the woodlands is largely the result of removal of ground cover. To answer the need for fuel the trees are cut and the ground is raked of all leaves, twigs and grasses annually. The exposed soil is subject to much erosion. Because of this some areas have been completely denuded and gullied, and have become a distinct liability to Korea. Most of the remainder has been eroded, lowering its potential production. Forest management to cover and protect the soil is urgently needed 2/. Only the high mountain areas, far from the populated zones, have been comparatively little affected by this problem.

1/ The subjects of bench terracing and erosion control are fully covered by the Final Report of the UNDP Agricultural Survey and Development Project in Korea, FAO, Rome 1969 (5 Vols.) Document No. FAO/SF:47/KOR-7.

2/ Appropriate recommendations have been made by the FAO executed UNDP Forest Survey Project (operational Nov. 1964 to Nov. 1968).

3. Acid Soils: Liming

3.1 The acidity problem

The acidity problem in Korean upland and paddy soils is very prevalent. Except for some soils developed on limestone and some others on broad alluvial plains near the sea, the reaction of the soils is moderately acid to strongly acid. In combatting this problem, it is advisable to consider the upland soils and the paddy soils separately, because of the nature of the acidity and the nature of the crops grown.

In well drained, reddish-yellow upland soils, the acidity is developed from exchangeable and nonexchangeable Al and H ions. The reaction does not show any significant difference under irrigated and nonirrigated conditions, or under field and laboratory conditions. Therefore, the lime requirements determined in the laboratory closely conform to the field conditions. Upland crops, such as barley, soybeans and other legumes, are very sensitive to soil reaction and the response to lime application is significant. For these reasons lime application to uplands has proceeded to some extent, but much remains to be accomplished. The lime requirements for uplands merit much more emphasis in the Government's new pasture development projects.

In flooded, dark grey paddy soils, acidity is also developed from oxidizable sulphurous compounds in addition to hydrogen and aluminium. The reaction shows a significant difference under irrigated (flooded) and nonirrigated conditions. On average, the pH rises by about one unit under flooded conditions. There is a similar difference in pH between flooded field conditions and the laboratory. In soils which remain flooded throughout the year, the field reaction remains moderately acid to slightly acid. This practice, however, tends to accumulate hydrogen, aluminium and other elements to the toxic limits. Studies have shown that some extremely acid Korean paddy soils contain iron sulphates but are not truly acid sulphate soils, because the oxidizable sulphurous compounds are below accepted limits for these soils. Their toxicity is caused by accumulated aluminium. Rice plants can tolerate slightly to moderately acid soil reaction, the pH which normally exists under flooded conditions. The lime requirements determined in the laboratory therefore do not conform to field conditions and if the field pH is considered, the lime requirement is low. The field experiments have, however, shown that lime application shows a favourable response. It is therefore considered that lime counteracts the toxic effects of aluminium and has some additional beneficial physiological role. Further studies on paddy soils are necessary to confirm their lime requirement and the role of lime. It should be pointed out that if these single-cropped, flooded paddy soils are drained annually and double-cropped, their lime requirement will go up considerably. However, it may be hoped that the practice of liming and double-cropping would also favourably affect the paddy yield following the winter crop.

3.2 Lime requirements of soils

The lime requirement of the soils varies considerably and is best determined by a test of soil taken from a particular field which is to be planted to a specific crop. Where this is not possible an indication of the amounts needed for general crops other than rice can be calculated from the chemical data which have been determined for the series. Cation exchange capacity, pH and base saturation are the properties which determine lime requirements.

The higher the cation exchange capacity the greater the number of reaction sites of the soil. Therefore at the same percent base saturation the lime requirement is greater for soils with high cation exchange capacities.

The base saturation percent is directly related to the exchange acidity. If the percent base saturation is low there are more exchange acid sites to be neutralized and therefore the lime requirement is high. On the other hand if the base saturation percent is high, it means that many of the reaction sites are already occupied by basic cations and there are few reaction sites to be neutralized, so the lime requirement of the soil is low.

The most direct indication of soil acidity is not pH, as is normally believed, but is the exchange acidity which is reflected by the percent base saturation and cation exchange capacity. It has been shown by many workers that the lime requirement is negligible if the base saturation is above 80 percent and the 1:1 soil-water pH is above 6.5. Tables 5 and 6 have been prepared with this fact in view.

Table 5

LIME REQUIREMENT AS RELATED TO C.E.C. AND PERCENT BASE SATURATION

Base Saturation	C.E.C.				
	Very low	Low	Medium	Moderately high	High
	......tons/ha......				
Very low	2	3.4	5.4	8.0	13.5
Low	1.5	2.5	4.0	6.0	10.0
Medium	1	1.7	2.7	4.0	6.7
Moderately high	0.7	1.1	1.8	2.7	4.5
High	0.4	0.6	0.9	1.4	2.2

Table 6

C.E.C. AND PERCENT BASE SATURATION CLASSES USED FOR LIME REQUIREMENT

C.E.C.	me/100g	Base saturation	Percent
Very low	<3	Very low	<20
Low	5	Low	35
Medium	8	Medium	50
Moderately high	12	Moderately high	60
High	>20	High	>70

Notes: 1. If the C.E.C. value and the base saturation percent lie between the values given in Table 6 choose the next higher value for finding the lime requirement.

2. If the base saturation is abo e 80 percent but the 1:1 soil-water pH is below 6.5, compute lime requirement at the rate of 200 kg/ha for every 0.1 unit decrease in pH, e.g. if a soil has a pH of 6.00 and base saturation is above 80 percent, its lime requirement would be 200 x 5 = 1 000 kg or one ton/ha.

Table 7 shows examples of estimated lime requirements, given for a number of series, showing the variation in amounts needed when soils are used for general crops other than rice.

Table 7

LIME REQUIREMENT OF SELECTED SOIL SERIES

Soils Series	Ton/ha
Baegsan	2.6
Bancheon	5.0
Bonggye	8.0
Bongrim	5.2
Buyong	2.7
Gimhae	5.2
Haecheog	3.4
Honam	1.6
Mudeung	5.0
Myeongji	0.0

4. Saline Soils

Areas of tidal flats, mainly adjacent to the west coast, have been diked and converted to cropland 1/. Soluble salts still persist in most of these soils and limit crop yields. Properly designed drainage systems which include the use of tile drains are needed to remove these salts. Additional studies are needed on the nature of the soils and better ways of reclaiming them. Crops vary in their tolerance to salts and information is needed on the better crops to be grown during the reclamation period.

The Gwanghwal series has large amounts of soluble salts in its upper layers and crop yields are severely limited. Many other low-lying soils, including the Jeonbug, Buyong, Mangyeong, and Gimje soils have sodium in their lower horizons. However, crop yields on these soils are only slightly affected by salts. Before they were drained, the Gimhae, Bongrim, Deunggu, and Haecheog soils were similar to the saline soils. Much additional research is needed to define these soils and to evaluate the possible treatments.

5. Use of Fertilizers

The soils of Korea are lacking in plant nutrients. Optimum growth of crops can be obtained only with the use of adequate amounts of the right kind of fertilizers.

Soil surveys serve a useful purpose in studying the response of a particular soil to specific fertilizers. When fertilizer trials are conducted on known soils, it may normally be expected that similar responses will be obtained on all other similar soils. When this is true the results are helpful in making fertilizer recommendations and predicting responses for soils where trials have not been conducted.

The physical and chemical characteristics of a soil determine its supply of available plant nutrients. Study of these characteristics helps in understanding the responses of a soil to different fertilizers. The response to some fertility element on a particular kind of soil and the lack of response to the same element on another kind of soil may often be attributed to the differences in the chemical constitution of their parent materials.

The nutrient deficiencies observed by soil scientists in the field may sometimes help to obtain information on the response of fertilizers. Such facts are reported in the soil survey reports. These indications can be further confirmed by fertility trials on these soils.

1/ See Final Report of the UNDP Tidal Land Reclamation Survey Project, operational Feb. 1962 to Dec. 1966. FAO, Rome 1968 (4 Vols.) Document No. FAO/SF:52/KOR-4.

Beginning in 1966 the soils of the trial plots of the Korea Soil Fertility Project 1/ have been identified and described. Studies are now in progress to correlate the response of rice and barley to increments of fertilizers. These trials are mainly for the response to nitrogen, phosphorus, and potassium fertilizers.

If fertilizer trials are planned and evaluated on the basis of the kind of soil, much valuable information will be gained to increase the agricultural development.

6. Cropping Systems

The most important decision a farmer makes is selection of a cropping system. Many factors, including the value of the product, possible yield, availability of improved seed varieties, irrigation water supplies, climate, weed control, erosion control, and insect control affect the decision on the cropping system to be used on a farm or part of a farm. In Korea, apart from a few speciality crops, rice is the most profitable thing to grow, and the most productive soils are planted to rice. In some areas, although the soils are otherwise well suited for rice, there are inadequate water supplies, so low yields are obtained in dry years. Such areas would generally produce more food and give a greater return if planted to other crops.

In many areas, barley is grown during the winter season between rice crops in a double-cropping system. But in most years the planting of both rice and barley is delayed to a date later than the optimum because the preceding crop has not been harvested. Except for this double-cropping, most of the paddies are used almost exclusively for rice production.

Cropping systems that include grasses and legumes are needed to assist in erosion control in most areas of subclass IIe, IIIe, and IVe soils. The soils of subclass VIe need to be in grass, forest, or other cover.

The soils with dark-coloured surfaces such as Chahang and Sinbul are in areas of cooler climate and shorter growing seasons. These soils produce excellent crops of cabbage, radish, potatoes, and many other vegetables. Maize is grown on these soils, but in many areas early maturing maize varieties are needed, to ensure maturation before the frost.

1/ Operational from Nov. 1963 to Dec. 1969. Executed by FAO.

Part II

DESCRIPTIONS AND DATA

Chapter 8

METHODS OF SOIL ANALYSIS

1. Physical Methods

1.1 Preparation of soil samples

All samples received from the field in polyethylene bags were air-dried in shade and passed through a 2 mm sieve after gentle crushing with a wooden rolling pin. The fraction greater than 2 mm which did not pass through the sieve, was reported as gravel and its volume recorded as a percentage of the total. The fraction smaller than 2 mm stored in polyethylene bags was used in all the physical, chemical and mineralogical analyses of soils reported here.

1.2 Pipette method of particle-size analysis

The particle-size distribution of the fraction below 2 mm was determined by the pipette method of Kilmer and Alexander.

A 10 g air-dry sample is placed in a 50 ml tall beaker and treated with 30 percent H_2O_2 to remove organic matter. The contents are transferred to a centrifuge tube and centrifuged for 5 minutes at 2000 r.p.m. to remove dissolved mineral matter. The sample is dispersed using 100 ml of 5 percent sodium hexametaphosphate and shaken overnight. The sample is passed through a 300 mesh sieve to separate sand and the suspension passing through is collected in a 1000 ml graduated cylinder. The volume of the suspension is finally made up to one litre and allowed to stand. The particle fractions are taken after specified time intervals from specified depths by means of a pipette.

1.3 Moisture retention, 1/3 atmosphere

The moisture retention at 1/3 atmosphere was determined using a pressure-plate apparatus.

Duplicate 25 g samples are placed in the retainer rings on the porous plate. The samples are allowed to stand for 16 hours with excess water before applying pressure. A pressure of 345 cm of water (25.3 cm of mercury) is applied. The pressure is released 48 hours after the extraction started or when reading on the buret indicates that outflow has ceased from all samples. The moisture content is determined by drying the samples overnight at 105°C.

1.4 Moisture retention, 1/10 atmosphere

The method used was the same as for 1/3 atmosphere, using an extraction pressure of 100 cm of water.

1.5 Moisture retention, 15 atmospheres

The moisture retention at 15 atmospheres was determined with the help of a pressure-membrane apparatus.

Duplicate 25 g samples are placed in the retainer rings on the pressure membrane. The samples are allowed to stand for 16 hours with excess water. The excess water is then removed with a pipette or rubber syringe. An air pressure of 15 atmosphere (220 lb/inch^2) is applied to the soil chamber. When the outflow has markedly decreased a 4 lb/inch^2 differential pressure is applied to the rubber diaphragm at the top of the soil chamber. The samples are removed from the soil chamber 18 hours after the initial extraction of water or when the reading on an outflow buret indicates that equilibrium has been attained. The moisture content is determined by drying the samples overnight at 105°C.

1.6 Permeability

The method used was as follows.

The undisturbed soil cores (3 x 3 inch) are vertically mounted in a Buchner funnel with a filter paper on top. Another empty core is mounted on top with the help of a rubber ring. Permeability is determined with one inch constant water-head maintained by adjusting the constant-lever water reservoir. The time, volume and temperature are measured to calculate permeability.

1.7 Bulk density

Bulk density was calculated by dividing the weight of oven-dry cores by their volume.

2. Chemical Methods

2.1 pH

Soil pH was determined on 15 g samples in 1:1 soil water ratio, using a Beckman "Zeromatic" pH meter. KCl pH was determined in one normal solution using the same ratio as for water pH.

The suspensions are allowed to stand for half an hour with occasional stirring before the pH is read. The samples are well stirred just before taking the readings.

2.2 Exchangeable bases

The exchangeable cations Ca, Mg, K and Na in a neutral $\underline{N}$ NH_4OAC leachate were determined by a modified version of the method of Peech.

10 g of the sample are shaken with 50 ml of $\underline{N}$ NH_4OAC (pH 6.9) for half an hour and then filtered through a 5.5 cm Buchner funnel. The soil is leached with three additional 10 ml portions of $\underline{N}$ NH_4OAC. The leachate is diluted to volume in a 100 ml volumetric flask.

Ca and Mg were determined by the EDTA method of Gysling and Schwarzenback. K and Na were determined using a Beckman DU Flame Spectrophotometer.

2.3 Organic matter

Organic matter was determined by the indirect method of determining organic carbon and multiplying the results by the "Van Bemmelen Factor" of 1.724 to obtain the organic matter percentage. The organic carbon was determined using Tiurin's (1931) method.

2.4 Total nitrogen

The total nitrogen was determined by a modified version of the Kjeldahl method.

5 g of air-dried soil are transferred to a Kjeldahl flask. To this, 5 g of sulphate mixture containing 4.5 g of K_2SO_4 and 0.5 g of Cu SO_4 and 30 ml of concentrated H_2SO_4 are added. The contents are digested for half an hour to an hour until clear. The flask is cooled and 350 ml of H_2O are added. The distillation is carried out by the addition of some zinc powder and 50 ml of conc. NaOH. The distillate is collected in a flask containing 50 ml of 2 percent boric acid solution and 10 drops of the indicator (mixture of 0.5 percent of brom cresol green and 0.1 percent methyl red in 95 percent ethanol adjusted to pH 4.5). The distillate is titrated with standard 0.1N H_2SO_4.

2.5 Cation exchange capacity of soil

The cation exchange capacity of the soil was determined by using 1N NH_4OAC (pH 7.0) solution and a 5 g sample of the soil. The soil was washed free of salt using ethyl alcohol and $NH^+{}_4$ was determined by direct distillation of the soil with MgO.

2.6 Extractable acidity

Extractable or exchangeable acidity was determined by Yuan's method (1959) with some modification.

20 g of air-dry soil are extracted with 50 ml N KC1 and leached with three additional portions of 50 ml N KC1. The soil is drained thoroughly between successive leachings. The filtrate is titrated with 0.1N NaOH using phenolphthalein as an indicator. The milliequivalents of alkali used are recorded as total exchange acidity. One drop of 0.1 NHC1 is added to bring the solution back to colourless, 20 ml of 0.5N NaF is added, and the solution is back titrated with 0.1N HC1 to colourless. The end-point is considered to have been reached if the pink colour does not reappear in half a minute. The milliequivalents of acid used are recorded as exchangeable Al. The difference between total exchange acidity and exchangeable Al is reported as exchangeable H.

2.7 Free iron oxides

Free iron oxides in the soil were determined using a 2 g sample by the sodium dithionite-citrate-bicarbonate method of Mehra and Jackson. All the samples were subjected to two dithionite treatments and one rinsing with 40 ml of citrate solution.

2.8 Available P_2O_5

Available P_2O_5 was determined on a 5 g sample by the Lancaster method using 20 ml of extracting solution. A 10 minute shaking time was allowed before filtration. P_2O_5 was determined in the filtrate colorimetrically by developing the colour with ammonium molybdate 1-amino 2-naphthol 4-sulphonic acid.

2.9 Available K_2O

The values obtained for extractable or exchangeable K by the NH_4-acetate method were also used for available K_2O.

3. Mineralogical Methods

3.1 Cation exchange capacity of clay

The cation exchange capacity of clay was determined by using 1N Ca-acetate (pH 7.0) solution and 1 g of clay sample mixed with 2 g of quartz sand. In the last treatment with 1N Ca-acetate, a small portion of 1N $CaCl_2$ is added. The clay sample after saturation is washed free of salt using ethyl alcohol. The clay sample is then treated with 1N NaCl to replace adsorbed Ca and Ca is determined by EDTA titration.

3.2 Total chemical analysis of clay

The total chemical analysis of clay was carried out on a 1 g sample by the Na_2CO_3 fusion method. Silica was determined by the gravimetric method after treating the fusion product with conc. HCl and $HClO_4$. Fe was determined by the thiocyanate method, K_2O_3 by gravimetric method after precipitation with NH_4OH. Al_2O_3 was calculated by difference from K_2O_3 and Fe_2O_3. K_2O was determined by the flame spectrophotometer.

3.3 DTA analysis

Differential thermal analysis was conducted using <2n Ca-saturated samples. The samples were kept at 50 percent relative humidity (43.4 percent H_2SO_4) at 25°C for three days after mixing them with Al_2O_3 in equal proportion by weight. The samples were heated at a uniform rate of 10°C per minute. A Netsch DTA Model 404 from Germany was used.

3.4 X-ray analysis

X-ray analysis procedures were adopted from the method described by Jackson.

Chapter 9

SOIL SERIES DESCRIPTIONS

The soil series descriptions in the following pages are always subject to review and change as soil research and mapping are carried on. As more is learned about the characteristics and extent of a soil, the range of characteristics in the series may be extended or restricted and a revised description issued.

It may be that two soils which were considered different enough from each other to be two series will be found on further study to be within the allowable range for one, or that one series has been defined so broadly that it should be divided.

New series will be established as necessary, when sufficiently large areas of soils are found which are distinctly different from those already established. Any soil survey officer may propose a new series, supporting it with adequate description and evidence of sufficient extent. After review by the party chiefs and field supervisors, the correlation specialist approves and issues the official description.

Established Series
UKT, JFD
28 October, 1969

ANMI SERIES

The Anmi series is a member of the fine loamy, mixed, nonacid, mesic family of Dystric Fluventic Eutrochrepts (Alluvial soils). These soils have moderately thick dark reddish brown silt loam A1 or Ap horizons, dark gray Apg in paddy, and very thick dark reddish brown silt loam cambic B horizons. The C horizons are weakly stratified dark brown silt loam usually with gravel. They are developed on young alluvial fans and in narrow valley alluvial plains in alluvial materials derived from limestone soils.

Typifying Pedon: Anmi silt loam - paddy rice (Field description Pyeongchang Gun profile No. 134; colors are for moist soil.)

A pg -- 0 to 20 cm. Dark gray (5Y 4/1) silt loam; few coarse and medium prominent reddish brown (5YR 4/4) mottles; puddled, structureless (massive) breaking to weak coarse granular and medium blocky; friable, sticky and plastic; many fine dead rice roots; abrupt smooth boundary; pH 6.5.

A3 -- 20 to 30 cm. Brown to dark brown (7.5YR 4/2) silty clay loam; many fine distinct black (10YR 2/1) Mn mottles; weak fine to medium granular and subangular blocky structure; firm, sticky and plastic; few fine discontinuous random inped simple tubular pores; few fine dead rice roots; clear smooth boundary; pH 7.0.

B1 -- 30 to 60 cm. Dark reddish brown (5YR 3/4) slightly gravelly silty clay loam; few fine prominent light gray (10YR 6/1) exped mottles decreasing with depth; weak medium and fine subangular blocky structure; slightly firm, sticky and plastic; few fine discontinuous random inped simple tubular pores; few coarse worm holes and casts; no roots; diffuse smooth boundary; pH 7.0.

B2 -- 60 to 130 cm. Dark brown (7.5YR 3/2) silty clay loam; weak and moderate medium and coarse subangular blocky structure; firm, sticky and plastic; less gravel than above; few fine discontinuous random inped simple tubular pores; few coarse worm holes and casts; pH 6.5.

Type Location: Pyeongchang Gun, Gangweon Do, about 100 m. south of Samgeo Ri, Bangrim Myeon.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. and depth to bedrock is more than 2 meters. The base saturation varies but is considered as being more than 60 percent. Reaction is slightly acid to neutral, generally increasing somewhat with depth. Ap horizons are reddish brown, dark reddish brown, brown or dark brown silt loam, light silty clay loam or loam. Where used for flood irrigated paddy rice, the Apg horizons may be gray, dark gray, reddish gray, dark reddish gray or dark grayish brown. Few pieces of gravel may occur. The cambic B horizons are reddish brown, dark reddish brown or dark brown silt loam, silty clay loam or loam with a small amount of gravel. Gray mostly exped mottles decreasing with depth may occur in the upper part of this horizon in areas used for paddy rice. The C horizons are brown, dark brown or dark reddish brown stratified gravelly silt loam, loam, or light silty clay loam with few gravel pieces, cobble or stone.

Competing Series and Their Differentiae: These are the Anyong, Maji, Paegsan, Jangweon, Panho, Imdong and Ihyeon series. The Anyong soils have argillic B horizons and are formed in granitic areas. The Maji soils are similar except for having gravelly textures. The Paegsan soils have paler colors, more acid reaction and are derived from granitic soil materials. The Jangweon soils contain fragipan horizons and have more acid reaction. The Panho soils are less red, more acid in reaction, have gravelly textures throughout and are derived from grayish brown shale soil materials. The Imdong soils have gravelly coarse loamy textures, reddish brown colors, more acid reaction and are derived from reddish brown shale soil materials. The Ihyeon soils have coarser silty textures, less red colors, more acid reaction, contain mica and are on broad alluvial plains.

Setting: The Anmi soils occur in small valley local alluvium and local alluvial fan deposits derived from limestone soil materials. Slopes are dominantly 2 to 7 percent and range from 1 to 15 percent.

Principal Associated Soils: The Maji, Mitan and Jangseong soils are associated. The Maji soils are in similar slightly more sloping positions with more than 35 percent gravel. The Mitan soils have clayey skeletal textures and are in local valleys, usually at higher elevations in stony colluvium. The Jangseong soils occur in residual upland positions.

Drainage and Permeability: Well drained. Permeability is slow to moderate and runoff is moderate depending on the slope.

Use and Vegetation: These soils are usually planted to corn, barley, vegetables or flood irrigated rice.

Distribution and Extent: The Anmi soils are of small extent and are distributed in the east central parts of the country in limestone areas. They are locally important agricultural soils.

Series Established: Pyeongchang Gun, Gangweon Do, 1968.

Remarks: Although naturally well drained, the typifying pedon is in flood irrigated rice paddy and has chromas of 2 or less within the upper 50 cm. The Base Saturation of this sample is somewhat lower than typical for the series, as it commonly exceeds 60 percent.

Lab. Nos. Mh320-323 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 20	Apg	0.2	1.6	3.0	3.3	4.2	4.4	56.4	27.1	SiCL	8.4	21.5	43.0	LiC
20- 30	A3	3.3	1.3	2.4	3.3	2.5	6.9	58.7	24.9	SiL	7.4	27.2	41.1	CL
30- 60	B1	14.4	2.0	3.3	4.1	5.2	4.8	52.9	27.7	SiCL	10.1	22.6	39.6	LiC
60-130	B2	2.8	——	2.4	——	1.8	2.9	63.9	29.0	SiCL	2.7	19.9	43.4	SiC

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Sat.% CEC	Sum of Cations
46.3	41.2	22.9	5.4	4.0	3.57	40	10.95	3.28	0.53	0.00	0.18	-	36.4	-
40.7	36.2	13.7	6.6	5.4	1.83	8	13.00	5.60	1.37	0.03	0.22	-	55.5	-
33.2	29.3	10.9	6.9	5.4	1.59	19	13.55	6.20	1.68	0.03	0.20	-	59.9	-
-	30.0	13.2	6.5	5.3	1.59	9	15.00	6.30	1.82	0.08	0.25	-	56.3	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
27 October, 1969

ANYONG SERIES

The Anyong series is a member of the fine loamy, mixed, mesic family of Typic Hapludalfs (Alluvial-Red-Yellow Podzolic soils with high base saturation). These soils have dark brown gravelly loam A horizons and deep dark yellowish brown gravelly loam Bt horizons over dark yellowish brown very gravelly loam C horizons. They are developed in mountain foot slope positions in colluvial materials derived from soils formed from acid and intermediate crystalline rocks.

Typifying Pedon: Anyong loam - barley (Field description Sangju Gun profile No. 282; colors are for moist soil.)

Ap -- 0 to 10 cm. Dark yellowish brown (10YR 4/4) sandy loam; weak very fine and fine granular structure; friable, nonsticky and nonplastic; common fine yellow mica; few fine gravel pieces; many fine and medium living barley roots; abrupt smooth boundary.

B1t -- 10 to 25 cm. Dark yellowish brown (10YR 4/4) gravelly sandy loam; weak medium and coarse subangular blocky structure, breaking easily to fine and medium granular; firm, slightly sticky and slightly plastic; common fine and medium discontinuous random tubular pores; approximately 10 percent weathered granite gravel and cobbles; few fine barley roots; gradual smooth boundary.

B21t -- 25 to 50 cm. Brown to dark brown (10YR 4/3) cobbly loam; moderate medium to coarse subangular blocky structure; firm, sticky and slightly plastic; thin discontinuous clay cutans; many fine and very fine discontinuous random tubular pores; approximately 15 percent slightly weathered granite gravel and cobbles; few fine roots; clear smooth boundary.

B22t -- 50 to 90 cm. Strong brown (7.5YR 5/6) cobbly loam; moderate medium to coarse subangular blocky structure; few discontinuous reddish brown (5YR 4/3) clay cutans; few worm casts; firm, very sticky and plastic; common fine to medium discontinuous oblique exped tubular pores; approximately 20 percent cobbles and stones; no roots.

Type Location: Gyeongsangbug Do, Sangju Gun, approximately 4 km. southeast of Sangju Eup, Geodong Ri.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is more than 3 meters. Base saturation is more than 60 percent throughout the profiles. Between 10 and 35 percent slightly weathered gravel, cobbles and stones occur in the solum, and more than 35 percent occur in the C horizons. The Ap or A horizons are 15 to 25 cm. thick, brown, dark brown, dark yellowish brown or pale brown gravelly loam or sandy loam where cultivated for upland crops; or grayish brown or gray with mottles where cultivated for paddy rice. Bt horizons are yellowish brown, strong brown or dark yellowish brown gravelly or cobbly loam or clay loam with none or few clay cutans and subangular blocky structure. C horizons are yellowish brown, pale brown or brown very gravelly or very cobbly loam or clay loam, weakly stratified.

Competing Series and Their Differentiae: These are the Gaghwa, Banho, Imdong, Seogto, Jangweon, Anmi, Baegsan and Maji soils. The Gaghwa soils have fine clayey textures and yellowish red argillic Bt horizons. The Banho soils have fine loamy cambic B horizons and are formed in gravelly alluvial-colluvial soils materials derived from gray shale geology. The Imdong soils have fine loamy cambic B horizons. The Jangweon soils have fragipan horizons. The Anmi soils have slightly acid to neutral reaction and are formed in local alluvial materials in limestone areas. The Maji soils have loamy skeletal textures and are formed in alluvial-colluvial materials in limestone areas. The Baegsan soils are formed in gravel free local alluvial granitic soil materials.

Setting: The Anyong soils occur on sloping or gently sloping slightly dissected alluvial-colluvial fans below steep mountain areas of granite-gneiss, granite, andesite porphyry and similar materials in position which receive some seepage water. Dominant slopes are 7 to 15 percent and slope range is from 2 to 30 percent.

Principal Associated Soils: The Taehwa, Mudeung, Samgag and similar soils are usually on the slopes above the Anyong soils. Jangweon, Seogto and Gaghwa soils are associated in somewhat similar physiographic positions. The Seogto soils occur on sloping portions of the alluvial-colluvial fans close to the mountain while the associated Jisan soils are on the alluvial plains of local streams which have dissected the alluvial fans.

Drainage and Permeability: The Anyong soils are well drained and moderately or moderately slowly permeable. Runoff is medium depending on the slope and land use.

Use and Vegetation: Most of these soils are used for upland crops such as barley, soybean, tobacco, mulberry and vegetables. Paddy rice is grown only to a limited extent due to lack of available irrigation water. A few areas grow pine forest and fuel wood.

Distribution and Extent: The Anyong soils are of moderate extent and are distributed chiefly in hilly and mountainous areas of the country with granitic and andesite porphyry geology.

Series Established: Sangju Gun, Gyeongsangbug Do, 1968.

Anyong Series Contd.

Lab. Nos. Fr251-254 **Typifying Pedon**

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0-10	Ap	3.8	7.0	12.8	18.7	3.5	28.0	24.5	5.5	SL	41.3	41.5	11.7	SL
10-25	B1t	12.5	4.6	11.3	15.5	14.2	8.6	34.6	11.2	SL	33.5	36.7	18.6	SL
25-50	B21t	15.0	4.3	7.8	9.3	8.8	5.5	45.3	18.7	L	22.7	27.4	31.2	L
50-90	B22t	15.8	7.3	11.0	11.8	10.4	6.6	31.4	21.5	L	31.5	24.9	22.1	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations Ca	Mg	Na	K	H
								me/100g					
22.0	15.7	5.4	1.25	5.2	3.7	1.54	17	5.25	3.25	1.15	0.13	0.23	0.50
22.2	17.2	6.3	1.46	5.8	4.0	1.03	17	6.45	4.15	1.35	0.18	0.10	0.15
27.9	22.7	8.7	1.41	6.2	4.2	0.93	17	7.80	4.80	1.75	0.35	0.13	0.10
29.6	23.3	11.1	-	5.0	3.7	0.67	26	8.70	5.55	2.30	0.33	0.15	1.26

Base Saturation % CEC	Sum of Cations
90.5	99.0
89.6	97.5
90.1	98.6
95.7	97.0

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
30 October, 1969

PAEGGU SERIES

The Paeggu series is a member of the fine loamy, mixed, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have dark grayish brown silt loam Apg horizons and moderately deep dark gray silty clay loam cambic Bg horizons. Clg horizons are dark gray loam and C2g horizons are dark gray sandy loam stratified. They are developed in narrow valleys and on fans in alluvium derived from continental materials.

Typifying Pedon: Paeggu silt loam - paddy rice (Field description Gimje Gun profile No. 109; colors are for moist soil.)

Apl -- 0 to 9 cm. Brown to dark brown (10YR 4/3) silt loam; common fine to medium distinct strong brown (7.5YR 5/6) mottles; puddled, coarse prismatic structure when dry, breaking to weak medium to coarse granular; friable, slightly sticky and slightly plastic; common fine to coarse white and yellow mica; few fine to medium quartz grit; many fine to medium rice roots; abrupt smooth boundary; pH 5.1. See Remarks.

Ap2g -- 9 to 20 cm. Grayish brown (2.5YR 5/2) clay loam; many medium to coarse prominent yellowish red (5YR 4/8) mottles; coarse prismatic structure, breaking to weak coarse platy; firm, sticky and plastic; common fine to coarse white and yellow mica; few fine to medium quartz grit; many fine to medium dead rice roots; clear smooth boundary; pH 5.3.

Blg -- 20 to 33 cm. Very dark gray (2.5Y N3/) silty clay loam; common fine to medium distinct olive (5Y 4/3) mottles; weak coarse prismatic structure; firm, sticky and plastic; common medium to fine continuous verticle inped simple tubular pores; many fine to coarse white and yellow mica; few fine quartz grit; many fine to medium roots; clear smooth boundary; pH 5.5.

B2g -- 33 to 55 cm. Gray (5Y 5/1) loam; common coarse prominent dark red (2.5YR 3/6) and yellowish red (5YR 4/8) mottles; weak coarse prismatic structure; common medium to coarse soft white $FeCO_3$ concretions; friable, slightly sticky and slightly plastic; mica, quartz grit, pores, and roots as above; diffuse smooth boundary; pH 5.6.

Cg -- 55 to 120 cm. Dark gray (5Y 4/1) loam; many coarse soft white $FeCO_3$ concretions; structureless (massive); friable, slightly sticky and slightly plastic; common undecomposed pieces of organic matter; mica, quartz grit and pores as above; pH 5.2.

Type Location: Gimje Gun, Jeollabug Do, 500 meters southeast of Paegsan Primary School, Heungsa Ri, (Jaenae Burag) Paegsan Myeon.

Range in Characteristics: The solum ranges from 50 to 100 cm. and depth to hard rock is more than 3 meters. Base saturation is more than 60 percent. Reaction is strongly to medium acid except where limed. Many to common mica flakes occur throughout the profile. Apg horizons, 15 to 25 cm. thick, are dark grayish brown, grayish brown or gray silt loam, loam or light silty clay loam with mottles. The cambic Bg horizons are dominantly dark gray, very dark gray or dark grayish brown silty clay loam, clay loam or loam with strong brown, yellowish red, dark red or yellowish brown mottles. Ferrous carbonate mottles ($FeCO_3$) may occur in the Bg horizons. Cg horizons are gray or dark gray loam to silt loam weakly stratified and may contain between 10 to 20 cm. of dark colored mineral peaty layers. Coarse loamy textures generally occur below about 120 cm.

Competing Series and Their Differentiae: These are in the Gangdong, Jisan and Sugye series. The Gangdong soils have fine loamy over sandy textures. The Jisan soils have browner colors and are imperfectly drained. The Sugye soils have fine silty textures and occur on broad alluvial plains.

Setting: The Paeggu soils occur on nearly level to gently sloping narrow valley alluvial plains and alluvial fans where slopes range from 2 to 15 percent and dominant slopes are 2 to 7 percent.

Principal Associated Soils: In addition to the completing series, the Sindab soils with sandy textures are associated.

Drainage and Permeability: Poorly drained. Runoff is ponded or very slow. Permeability is moderate. The watertable is near the surface through the year except where artificially controlled.

Use and Vegetation: Most of these soils are used for rice only.

Distribution and Extent: The series is small in extent and occurs throughout the southern portion of the country.

Series Established: Gimje Gun, Jeollabug Do, May 1967.

Remarks: The brown Apl in rice paddy landuse is apparently due to the recent addition of reddish upland soil as is commonly practiced by farmers.

Lab. Nos. Dm227-231 **Typifying Pedon**

Depth cm	Hori- zon	Gra- vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex- tural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 9	Ap1	5.2	1.8	5.1	5.9	6.0	3.9	51.1	26.2	SiL	14.7	21.0	38.1	LiC
9- 20	Ap2g	7.0	4.2	6.4	6.2	6.0	3.7	45.8	27.7	CL	18.4	18.3	35.6	LiC
20- 33	B1g	2.8	1.9	3.7	4.2	5.6	3.7	60.9	30.0	SiCL	11.2	18.3	40.5	LiC
33- 55	B2g	0.0	2.5	5.8	6.2	7.8	5.9	46.7	25.1	L	16.6	23.2	35.1	LiC
55-120	Cg	0.0	1.8	4.2	6.2	11.8	6.8	45.5	23.7	L	15.1	26.2	35.0	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g /cc	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg	Na	K	H (me/100g)	Base Saturation % CEC	Sum of Cations
47.5	37.9	13.5	-	4.8	4.1	2.60	9.10	2.15	1.25	0.22	0.15	1.66	41.4	69.4
46.0	35.5	13.7	1.28	5.0	4.2	3.14	9.10	2.80	1.37	0.20	0.15	1.06	49.3	80.9
44.0	36.0	16.9	1.28	5.0	4.4	2.92	10.10	4.00	1.80	0.22	0.10	0.61	60.6	90.9
39.8	32.3	13.1	1.26	5.0	4.2	2.43	8.65	3.12	1.25	0.35	0.10	1.01	55.7	82.7
39.1	31.9	10.4	1.34	4.6	3.9	4.45	9.55	2.32	0.87	0.15	0.10	1.72	36.0	66.7

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
3 November, 1969

PAEGSAN SERIES

The Paegsan series is a member of the fine loamy, mixed, mesic family of Dystric Fluventic Eutrochrepts (Alluvial soils). These soils have moderately thick brown to dark brown loam to sandy loam A horizons and deep brown to dark brown loam to silt loam cambic B horizons with weakly developed structure and slight increase in hue. The C horizons are very thick yellowish brown to strong brown stratified fine loamy or coarse loamy materials. They are developed in narrow valley and footslope positions in local alluvial-colluvial and alluvial fan deposits derived from granitic materials.

Typifying Pedon: Paegsan sandy loam - barley (Field description Damyang Gun profile No. 11; colors are for moist soil.)

Alp -- 0 to 17 cm. Brown to dark brown (10YR 4/3) sandy loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; common fine random exped and inped dendritic pores; few fine mica; common fine soybean roots; abrupt smooth boundary; pH 5.2.

A1 -- 17 to 30 cm. Dark yellowish brown (10YR 4/4) loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; common medium to coarse random exped and inped dendritic pores; few fine white mica; very few fine living soybean roots; clear smooth boundary; pH 5.6.

B1 -- 30 to 68 cm. Brown to dark brown (7.5YR 4/4) loam; weak coarse subangular blocky structure breaking in hand to moderate fine, medium and coarse subangular; firm, slightly sticky and slightly plastic; common medium random inped tubular pores; few fine mica; very few very fine roots; clear smooth boundary; pH 5.8.

B2 -- 68 to 120 cm. Brown to dark brown (7.5YR 4/4) or strong brown (7.5YR 5/6) loam; weak medium subangular blocky structure as above; slightly firm, sticky and slightly plastic; few fine random inped tubular pores; few fine mica; approximately 5 percent weathered granitic gravel; pH 5.8.

Type Location: Damyang Gun, Jeollanam Do, about 500 meters west of Ganghwa Village, Ganghwa Ri, Changpyeong Myeon.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. and depth to weathered residuum is greater than 200 cm. Coarse fragments (grit and fine gravel) are less than 10 percent throughout the solum and generally increase slightly with depth. Base saturation is variable but generally more than 60 percent. Reaction is strongly to medium acid increasing slightly with depth Ap or A1 horizons are brown or dark yellowish brown sandy loam, loam or silt loam. A horizon thickness ranges from about 20 to 30 cm. The cambic B horizons are brown, strong brown, dark yellowish brown, or yellowish brown loam, silt loam silty clay loam or light clay loam with less than 10 percent gravel and 18 to 35 percent clay. Few or common fine white and yellowish mica occur throughout the profiles. C horizons are stratified brown, dark brown, yellowish brown, strong brown or dark yellowish brown silty clay loam, silt loam, loam, clay loam or sandy loam. C horizons are commonly less clayey and more distinctly stratified than B horizons. Paleosols may occur.

Competing Series and Their Differentiae: These are the Weondang, Anmi, Jangweon, Maji, Seongsan, Panho, Sangju, Anyong and Toggye series. The Weondang soils have yellowish red or red colors. The Anmi soils have slightly acid to neutral reaction and are formed in local alluvial materials from limestone soils. The Maji soils have loamy skeletal textures, higher reaction and are formed in limestone areas. The Jangweon soils have fragipan horizons and restricted moisture and plant root movement. The Maji soils have loamy skeletal textures, near neutral reaction, high base saturation and limestone parent materials. The Seongsan and Sangju soils are in the coarse loamy texture family. The Panho soils are gravely, mica free and are derived from gray shale soils. The Anyong soils have fine loamy textures, argillic B horizons and are formed in dissected mountain colluvial positions. The Togye soils are in the sandy texture family.

Setting: The Paegsan soils occur in gently sloping to sloping local valley alluvial plains and on footslopes in local alluvial-colluvial and alluvial fan positions in materials washed mainly from yellowish red granitic soils. Dominant slopes are 2 to 7 percent and range from 2 to 30 percent.

Principal Associated Soils: The Jeonnam, Gwangsan, Songjeong, Samgag, Pancheon, Bansan and Jisan soils are associated. The red clayey Jeonnam, Gwangsan, Bonggye and Pancheon soils in uplands are the dominant source materials. The fine loamy Songjeong and coarse loamy Samgag are also associated in upland positions. The Bansan soils are associated in slight depressions, foot slopes and at the heads of drainage ways. The Jisan soils are associated in local alluvial plains.

Drainage and Permeability: Well drained. Runoff is moderate depending on slope gradient and permeability is generally moderately slow.

Use and Vegetation: Most areas are used for red pepper, soybean, barley, wheat, cabbage, millet, tobacco, radish and similar nonirrigated upland crops. Ginseng and mulberry are sometimes grown. Paddy rice is rarely grown due to limited irrigation water supply.

Distribution and Extent: The Paegsan soils are of small total extent though they occur in many small areas in local valleys associated with residual granite or granite gneiss soils. They occur chiefly in the southwestern part of the country and to less extent in scattered areas throughout the granitic regions of the whole country.

Series Established: Gimje Gun, Jeollabug Do, 1967.

Remarks: Where associated with the Bonggye series, the Baegsan series contains little or no mica.

Lab. Nos. Ee41-44 **Typifying Pedon**

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 17	A1p	6.4	4.8	10.5	13.9	13.5	10.9	32.1	14.3	SL	31.4	34.2	20.1	SL
17- 30	A1	6.9	5.3	8.6	11.7	12.0	10.1	33.6	18.7	L	27.9	29.6	23.8	CI
30- 68	B1	6.4	4.8	8.1	10.8	10.9	9.0	34.1	22.3	L	25.8	27.7	24.2	CL
68-120	B2	10.0	8.0	9.6	10.6	10.0	7.4	30.9	23.5	L	30.1	24.9	21.5	CL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	22.2	8.4	5.2	3.8	2.00	9.90	1.80	1.75	0.22	0.25	0.70	40.6	85.2
	23.3	10.3	5.6	4.0	1.14	10.60	6.25	2.75	0.15	0.10	0.35	87.3	96.4
	23.1	11.0	5.8	4.1	1.16	10.85	6.62	3.37	0.05	0.08	0.15	93.3	98.5
	20.8	10.0	5.8	4.3	1.03	8.60	3.55	2.32	0.10	0.10	0.15	70.6	97.6

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
31 October, 1969

BANCHEON SERIES

The Bancheon series is a member of the fine clayey, mixed, mesic family of Typic Hapludalfs (Red-Yellow Podzolic soils with high base saturation). These soils have brown to dark brown silty clay loam Ap or A1 horizons and yellowish red silty clay Bt horizons. The C horizons are strongly weathered stratified variably gravelly and clayey old alluvium derived from continental materials. These soils are developed on dissected relatively high stream terraces.

Typifying Pedon: Bancheon silty clay loam - rotated barley and recently flood irrigated rice. (Field description Damyang Gun profile No. 27; colors are for moist soil.)

Ap1 -- 0 to 11 cm. Brown to dark brown (10YR 4/3) silty clay loam; few fine to medium faint strong brown (7.5YR 5/6) mottles; moderate fine and medium granular structure; friable, sticky and plastic; many fine roots; abrupt smooth boundary.

Ap2 -- 11 to 21 cm. Yellowish brown (10YR 5/6) silty clay loam; common fine faint brown to dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; firm, sticky and plastic; few fine pores; common fine roots; clear smooth boundary.

B21t -- 21 to 40 cm. Yellowish red (5YR 4/6) silty clay; moderate coarse prismatic breaking to moderate coarse subangular blocky structure; moderately thick continuous brown to dark brown clay cutans; few soft medium Mn concretion; firm, sticky and plastic; few fine and medium pores; few fine roots; clear wavy boundary.

B22t -- 40 to 80 cm. Yellowish red (5YR 4/6) silty clay; moderate coarse prismatic structure, breaking to moderate medium subangular blocky; moderately thick continuous reddish brown clay cutans; firm, sticky and plastic; pores as above; no roots; clear wavy boundary.

B3 -- 80 to 110 cm. Mottled yellowish red (5YR 5/8) and strong brown (7.5YR 5/6) silty clay loam; crushed color strong brown (7.5YR 5/6); weak prismatic structure breaking to weak coarse subangular blocky; common medium soft Mn concretions; thin continuous clay cutans on prism faces; about 7 percent weathered round granitic gravel.

Type Location: Damyang Gun, Jeollanam Do, about 300 meters east of Subug Myeon seat, Haebangcheon Ri, Subug Myeon.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. and depth to hard rock is more than 2 meters. Base saturation is more than 60 percent. Reaction is medium to slightly acid. The Ap or A1 horizons are brown, dark brown, dark yellowish brown or reddish brown silt loam, loam, clay loam or silty clay loam. The finer surface textures generally occur in eroded areas. Apg horizons occur in areas used for paddy rice for several years or more. The argillic Bt horizons are yellowish red, red, reddish brown or reddish yellow silty clay, clay, heavy silty clay loam or heavy clay loam containing between 35 and 60 percent clay. The C horizons are yellowish red, yellowish brown, or strong brown stratified silty clay loam, silty clay, clay loam, sandy clay loam or loam with less than 35 percent gravel. Source materials are mainly granitic soils.

Competing Series and Their Differentiae: These are the Changpyeong, Gwangju, Jeonnam, Gwangsan, Hwadong, Gongseong and Jingog series. The Jingog and Gwangju soils have silty mantles overlying the main argillic Bt horizons. The Changpyeong soils have more strongly developed structure, somewhat finer textures and redder colors. The Hwadong and Gongseong soils have gray mottle colors in the lower Bt horizons. The Gwangsan and Jeonnam soils have lower base saturation and are derived from residual granitic materials.

Setting: The Bancheon soils occur on very gently sloping to undulating and some rolling moderately dissected river and fan terraces of old pediplane systems and are developed in deep old alluvial materials. The larger areas occur in the vicinity of the confluence of main streams. Dominant slopes are 7 to 15 percent and the slope range is from 2 to 30 percent.

Principal Associated Soils: The Changpyeong, Gwangju, Banggi, Jeonnam, Hwadong, Geugrag, Wangsan and Gongseong soils are associated with the Bancheon soils. The Changpyeong and Gwangju soils occur in similar physiographic positions with slightly higher elevations. The Banggi soils commonly are associated on terrace edges. The Jeonnam soils usually are associated on lower side slopes and slightly higher landscape positions. The Wangsan soils have thick dark A horizons. The Hwadong, Geugrag and Gongseong soils occupy lower terrace portions and have gray mottles in the lower B horizons.

Drainage and Permeability: Well drained. Permeability is slow and runoff is medium to rapid depending on slope and land use.

Use and Vegetation: Most areas are used for barley, wheat, soybean, red pepper, sweet potato, tobacco, red bean and similar nonirrigated crops. Some areas are used for flood irrigated rice where sufficient water is available.

Distribution and Extent: The Bancheon soils are of rather large extent, are agriculturally important and are distributed throughout the country along the main rivers.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966.

Remarks: When used for flood irrigated rice for five years or more during the summers and for nonirrigated barley during the winters, a moderate Apg horizon may be formed. Except for the high base saturation, these soils would be in the Typid Hapludult subgroup.

Lab. Nos. Ee100-104 **Typifying Pedon**

Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	Intl. CS 2-.2	Intl. FS .2-.02	Intl. Silt .02-.002	Intl. Textural Class
			Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture								International			
0- 11	Ap1	0.0		4.4		3.2	2.8	56.0	33.7	SiCL	4.9	24.8	36.6	LiC
11- 21	Ap2	0.0		4.9		3.2	3.0	55.1	33.8	SiCL	5.6	29.9	30.7	LiC
21- 40	B21t	0.0		1.5		1.2	1.2	52.3	43.8	SiC	1.8	30.0	24.4	LiC
40- 80	B22t	0.0		2.5		1.7	1.4	43.8	50.6	SiC	2.9	13.5	33.0	HC
80-110	B3	0.0		9.1		4.2	3.9	46.5	36.3	SiCL	9.9	22.7	31.1	LiC

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g /cc	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	Free Fe_2O_3 %	2/ CEC	Ca (me/100g)	Mg	Na	K	H
	37.6	18.8	1.39	5.3	4.1	3.41	–	1.58	10.40	2.75	0.72	0.17	0.20	1.81
	33.1	18.8	1.39	5.6	4.3	3.26	41	1.67	10.40	3.50	1.10	0.17	0.10	0.95
	33.4	18.2	1.40	6.4	4.8	1.48	19	2.17	12.40	5.12	3.12	0.40	0.15	0.15
	30.9	19.4	–	6.5	4.9	1.74	11	2.38	12.25	5.25	3.38	0.30	0.22	0.10
	34.0	16.5	–	6.3	4.6	1.21	8	2.33	8.45	3.12	1.87	0.20	0.15	0.36

Base Saturation % CEC	Sum of Cations
36.9	68.0
46.8	83.7
70.9	98.3
74.7	98.9
63.2	93.7

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KPJ, JFD
3 November, 1969

BANGGI SERIES

The Banggi series is a member of clayey-skeletal, mixed, mesic family of Typic Hapludalfs (Red-Yellow Podzolic soils with high base saturation). These soils have brown to dark brown A1 or Ap horizons, grayish brown loam or clay loam Apg horizons, moderately deep yellowish red firm very gravelly clay loam or very gravelly clay Bt horizons and strong brown very cobbly silty clay loam to very cobbly clay C horizons. They occur on dissected terrace and alluvial fan remnants.

Typifying Pedon: Banggi loam - rice paddy (Field description Ulju Gun profile No. 32; colors are for moist soil.)

Ap1g -- 0 to 11 cm. Very dark gray (10YR 3/1) loam; moderate fine to coarse granular structure; friable, slightly sticky and slightly plastic; few very fine and fine discontinuous random inped dendritic vesicular pores; approximate 3 percent hard unweathered granite gravel; many fine and medium rice roots; gradual smooth boundary; pH 5.8.

Ap2g -- 11 to 30 cm. Very dark gray (10YR 3/1) gravelly loam; common medium and coarse dark reddish brown (2.5YR 3/4) and yellowish brown (10YR 5/8) mottles; weak fine to coarse subangular blocky structure breaking to fine and very fine granular; slightly firm, slightly sticky and slightly plastic; few fine and medium discontinuous random and oblique exped and inped simple tubular pores; 10 to 20 percent granite gravel; common very fine and fine rice roots; abrupt smooth boundary; pH 5.5.

B21t -- 30 to 40 cm. Mottled yellowish red (5YR 5/6 and 5/8), dark red (2.5YR 3/6) and strong brown (7.5YR 5/6) gravelly clay; crushed color brown to dark brown (7.5YR 4/4); strong medium and coarse prismatic structure breaking to medium and coarse subangular blocky; common dark gray (10YR 4/1) exped mottles decreasing with depth; firm, very sticky and very plastic; many fine and medium continuous vertical inped and exped simple tubular pores; 5 to 10 percent slightly weathered granite gravel; few very fine and fine dead rice roots; gradual smooth boundary; pH 5.0.

B22t -- 40 to 120 cm. Mottled yellowish red (5YR 4/8), dark red (2.5YR 3/6) and brown to dark brown (7.5YR 4/2) very gravelly clay; crushed color brown to dark brown (7.5YR 4/4); strong coarse to fine subangular blocky structure; continuous thick clay cutans; common medium black (7.5YR N2/) Mn concretions; consistence as above; many fine to coarse continuous vertical and horizontal inped and exped simple and open tubular pores; 40 to 50 percent unweathered to moderately weathered granitic gravel and cobbles; roots as above; about 70 to 80 percent gravel and cobbles occur below 80 cm.

Type Location: Ulju Gun, Gyeongsangnam Do, about 500 meters south Unyang Myeon seat.

Range in Characteristics: The solum thickness is more than 100 cm. Reaction is very strongly to strongly acid. Base saturation is more than 60 percent. Apg horizons are grayish brown, dark grayish brown or dark gray where cultivated for paddy rice due to reduction under flood irrigation. Ap or A1 horizons are brown to dark brown loam, clay loam, silt loam or silty clay loam where cultivated for upland crops. In most areas used for cultivated crops the larger gravel has been removed from the Ap and buried or piled aside by farmers. Thickness of the Ap and disturbed upper horizons ranges considerably, (10 to 30 cm.) particularly in areas used for rice paddy, due to leveling for flooding purposes. The Bt horizons are very thick yellowish red, strong brown, red or reddish brown very gravelly clay loam to very gravelly clay, extending below 100 cm. The C horizons are yellowish red, strong brown or yellowish brown sometimes mottled and usually stratified very gravelly and very cobbly clay loam or loam with minor strata of other textures beginning at depths between 100 and 150 cm. In general the gravel content and size increase with depth.

Competing Series and Their Differentiae: Competing soils are in the Jangyu, Gaghwa, Iweon, Bancheon, Hwadong, Gwangju, Changpyeong and Wangsan series. The Jangyu soils are moderately well drained and have mottles in chroma of 2 or less in the lower B horizons. The Gaghwa soils contain 10 to 35 percent coarse fragments in the B horizons and are formed in mountain colluvium. The Iweon soils have coarse loamy textures, cambic B horizons and contain 10 to 35 percent coarse fragments. The Bancheon soils are gravel free throughout the solum. The Hwadong soils are moderately well drained and gravel free throughout the solum. The Gwangju soils have a silty mantle and are free of coarse fragments in the solum. The Changpyeong soils are more strongly developed, gravel free and have redder subsoil colors. The Wangsan series is free of coarse fragments and has dark A horizon colors.

Setting: The Banggi soils occur on gently sloping to sloping stream terraces and terrace edges usually in mountain valleys. The source materials are derived from soils over light colored rocks such as granite, andesite porphyry, shale etc. Dominant slopes are from 2 to 15 percent. Slope range is from 2 to 60 percent.

Principal Associated Soils: These are in the Bancheon, Hwadong, Changpyeong, Gaghwa, Hogye and similar soils. The Hogye soils belong to the loamy-skeletal texture family and have dark colored surfaces. The Banho soils are less gravelly and have fine loamy textures.

Drainage and Permeability: Well drained. Permeability is slow. Runoff is medium.

Use and Vegetation: The Banggi soils are used for cultivated crops such as paddy rice, barley, wheat, sesame, soybean, sweet potato, red pepper and orchard.

Distribution and Extent: The Banggi soils are of small extent and occur on the rolling terraces in mountain valleys throughout most of the country.

Series Established: Ulju Gun, Gyeongsangnam Do, Banggi Ri, Samnam Myeon.

Remarks: The Apg horizons in the typifying pedon are somewhat thicker and the solum contains more organic matter than usual for the series. Most coarse fragments were excluded from the samples analyzed.

Lab. Nos. U198-201 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori- zon	Gra- vel 2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay .002	Tex- tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 11	Ap1g	3.6	0.8	4.4	10.4	15.9	8.8	39.1	20.6	L	19.1	31.7	28.6	CL
11- 30	Ap2g	3.9	1.4	5.4	11.4	17.2	9.5	36.5	18.6	L	22.0	34.8	24.6	CL
30- 40	B21t	4.4	0.6	3.0	6.4	10.4	6.1	38.4	35.1	CL	12.3	24.9	27.7	LiC
40-120	B22t	6.8	0.4	2.8	6.4	8.5	5.5	33.3	43.1	C	11.5	17.1	28.3	LiC

Moisture Retention %			S.G.	Atterberg Limits %		pH		O.M.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms		LL	PI	H2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
										me/100g						
	41.9	14.5	2.51	53.7	12.7	4.6	3.7	7.2	11.50	3.25	0.85	0.14	0.15	-	38.2	-
	33.1	12.7	2.56	45.8	11.5	4.8	3.7	4.7	9.30	2.50	0.40	0.15	0.08	-	34.7	-
	30.1	15.8	2.72	43.2	19.1	5.1	4.0	1.4	7.60	3.25	0.90	0.10	0.08	-	57.0	-
	30.8	17.9	2.73	47.0	23.0	5.3	4.1	1.0	12.00	6.50	1.75	0.38	0.13	-	71.9	-

Elemental Analysis of Clay			
SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %
2.78	60.39	5.22	33.52
2.64	58.71	5.64	34.09
1.75	45.76	22.14	30.21
2.20	52.75	9.38	34.67

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
3 November, 1969

PANHO SERIES

The Panho series is a member of the fine-loamy, mixed, mesic family of Dystric Fluventic Eutrochrepts (Alluvial soils). These soils have brown to dark brown gravelly silt loam Ap horizons and moderately deep dark yellowish brown gravelly silt loam cambic B horizons. C horizons are brown to dark yellowish brown gravelly silt loam increasing in gravel content with depth. Panho soils are formed on local alluvial fans in materials washed from grayish brown shale soils.

Typifying Pedon: Panho gravelly silt loam - soybean (Field description Dalseong Gun profile No. 102; colors are for moist soil.)

Ap -- 0 to 15 cm. Brown to dark brown (10YR 4/3) gravelly silt loam; moderate medium granular structure; friable, slightly sticky and slightly plastic; approximately 20 percent slightly weathered grayish brown shale gravel; many fine roots; abrupt smooth boundary.

B1 -- 15 to 30 cm. Dark yellowish brown (10YR 4/4) gravelly silt loam; weak medium and fine subangular blocky structure breaking to moderate fine granular; friable, slightly sticky and slightly plastic; approximately 25 percent gravel as above; common fine to medium pores; medium roots; few medium worm holes; gradual smooth boundary.

B2 -- 30 to 60 cm. Dark brown (10YR 3/3) gravelly silt loam; moderate to weak medium and fine subangular blocky structure; firm, slightly sticky and slightly plastic: about 30 percent gravel as above; few fine roots in upper part of this horizon.

B3 -- 60 to 90 cm. Brown (10YR 4/3) gravelly silt loam as above with more gravel and less distinct structure.

C1 -- 90 to 120 cm. As above very gravelly loam.

Type Location: Dalseong Gun, Gyeongsangbug Do, about 200 meters west of Geumpo Dong, Nongong Myeon.

Range in Characteristics: Solum thickness is 50 to 100 cm. and depth to hard rock is generally more than 3 meters. Reaction is medium to slightly acid. Base saturation is more than 60 percent. 10 to 35 percent slightly weathered to unweathered gray shale gravel occurs and commonly increases with depth. Ap horizons, 15 to 25 cm. thick, are brown, dark brown or dark yellowish brown, gravelly silt loam, loam, light silty clay loam or light clay loam. Cambic B horizons are yellowish brown, dark yellowish brown, strong brown or brown to dark brown gravelly silt loam, loam or silty clay loam. C horizons are brown, yellowish brown or dark yellowish brown gravelly or very gravelly silt loam, loam or silty clay loam.

Competing Series and Their Differentiae: These include the Iweon, Seogto, Gaghwa, Anyong, Hogye, Imdong, Baegsan, Anmi, Maji, Jangweon and Sinbul soils. The Iweon soils have coarse loamy textures and contain larger coarse fragments. The Seogto soils have loamy skeletal textures. The Gaghwa soils have fine clayey textures and yellowish red colors. The Anyong soils have fine loamy textures and argillic Bt horizons. The Hogye soils have loamy skeletal textures and dark colored surface horizons. The Imdong soils have coarse loamy textures, reddish brown colors and reddish brown shale soil parent materials. The Baegsan soils are gravel free, contain mica and are derived from granitic soils. The Anmi and Maji soils have near neutral reaction and occur in limestone areas. The Jangweon soils have fragipan horizons. The Sinbul soils have loamy skeletal textures and dark A horizons.

Setting: The Banho soils occur on sloping to moderately steep foot slopes and alluvial fans in materials washed from soils developed over grayish brown shale, fine textured and some conglomerate. Dominant slopes are 2 to 15 percent and range from 2 to 30 percent.

Principal Associated Soils: The Daegu, Mudeung, Jangweon and Seogto soils are associated on higher slopes. The Yuga soils are associated in local alluvial valleys at lower elevations.

Drainage and Permeability: Well drained. Runoff is medium or rapid and permeability is moderately slow.

Use and Vegetation: Most areas are used for barley, soybean, red pepper, wheat and similar upland crops. Very few areas are used for paddy rice or forest.

Distribution and Extent: The Banho soils are of moderate extent and occur in foot slope positions in areas of gray shale geology in the southeastern portion of the country.

Series Established: Ulju Gun, Gyeongsangnam Do, 1965.

Lab. Nos. T286-288 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) %: U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0-15	Ap	17.2	3.4	4.4	3.4	4.5	3.7	59.1	21.5	SiL	12.2	20.3	46.0	SiCL
15-30	B1	25.9	3.5	4.5	3.5	4.4	3.3	57.4	23.4	SiL	12.4	17.3	46.9	SiCL
30-60	B2	31.2	3.9	4.6	3.4	3.4	2.5	55.8	26.4	SiL	12.7	18.3	46.6	LiC

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H
	31.2	11.5	6.1	4.8	2.60	26	12.50	8.20	3.50	0.16	0.44	-
	30.2	11.1	5.3	3.8	1.80	6	11.30	6.40	3.00	0.26	0.12	-
	30.2	12.7	5.7	4.2	2.00	-	13.1	8.90	3.90	0.20	0.08	-

Base Saturation %: CEC	Sum of Cations
98.4	-
86.5	-
92.2	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UIT, FPJ, JFD
16 October, 1969

PANSAN SERIES

The Pansan series is a member of the fine clayey, mesic family of Humic Hapludults (Red-Yellow Podzolic soils). These soils have dark brown to very dark brown silt loam or loam A horizons with thickness less than 1/3 solum depth and deep strong brown to yellowish red clayey Bt horizons. C horizons have fine loamy textures and are formed in granite saprolite. These soils occur in slight depressions among red clayey residual soils containing mica.

Typifying Pedon: Pansan loam - barley (Field description Puyeo Gun profile No. 202; colors are for moist soil.)

Ap -- 0 to 15 cm. Dark brown (10YR 3/3) loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; few fine angular quartz gravel; common fine roots; clear smooth boundary.

A1 -- 15 to 35 cm. Dark brown (10YR 3/3) loam; weak medium subangular breaking to moderate fine and medium granular structure; slightly firm, slightly sticky and slightly plastic; few fine living roots; common fine pores; clear smooth boundary.

B1t -- 35 to 60 cm. Dark brown (7.5YR 3/2) silty clay loam; moderate fine subangular blocky structure; firm, sticky and plastic; thin continuous clay cutans; common fine pores; few fine living barley roots; clear smooth boundary.

B2t -- 60 to 110 cm. Yellowish red (5YR 4/6) silty clay; moderate coarse subangular blocky structure; firm, sticky and plastic; thin continuous clay cutans; common fine pores; few fine roots; clear smooth boundary.

B31t -- 110 to 130 cm. Brown to dark brown (7.5YR 4/4) silty clay; weak coarse subangular blocky structure; firm, sticky and plastic; common fine dark brown and very dark brown soft concretions; thin patchy clay cutans; gradual smooth boundary.

B32t -- 130 to 150 cm. Brown to strong brown (7.5YR 5/5) light clay; common medium light yellowish brown (10YR 4/4) inped mottles; moderate coarse platy breaking to moderate medium subangular blocky structure; very firm, sticky and plastic.

Type Location: Puyeo Gun, Chungcheongnam Do, 1.5 km. south of the Guryong Myeon Office, Dongyang Ri, Guryong Myeon.

Range in Characteristics: Solum thickness is commonly 150 cm. and ranges from 1 to 2 meters. Depth to hard rock is greater than 2 meters probably ranging to several meters. Reaction is strongly to medium acid throughout the profile and the base saturation is medium to low. A1 horizons are dark brown to very dark brown loam to silty clay loam with moist color values less than 3.5 and moist chromas less than 3.5. A horizons are 20 to 60 cm. thicker than those of similar soils owing to the gradual accumulation of materials from adjacent higher lying soils. Bt horizons range from yellowish red or dark reddish brown to strong brown heavy silt clay loam through silty clay with varying amounts of dark brown to black concretions commonly concentrated in some horizons. Clay content of the Bt horizon ranges from 35 to 60 percent. C horizons are yellowish brown, strong brown or yellowish red silt loam, silty clay loam or light silty clay granite saprolite. The Pansan soils in some places have buried B horizons of contrasting ages.

Competing Series and Their Differentiae: Related soils are the Paegsan, Jeonnam, Bancheon, Seongsan, Gwangsan, Bonggye, Dalcheon, Jingog and Cheongog soils. The Paegsan soils occur in similar topographic positions but have fine loamy textures and less distinct structure. The Jeonnam, Dalcheon and Gwangsan soils are developed on convex slopes in similar materials and have light colored upper horizons. The Seongsan soils have coarse loamy textures. The Bancheon soils lack dark colored A horizons and are derived from old alluvial materials. The Bonggye soils lack dark colored A horizons, are mica free and are derived from andesite porphyry rocks. The Jingog soils have light colored silty mantles. The Cheongog soils have dark red colors and dark colored basic parent materials.

Setting: The Pansan soils occur in slight depressions among the red fine clayey upland soils mainly in areas of undulating to rolling dissected old bedrock pediplains underlaid by granitic saprolite. Slopes range from 2 to 15 percent and dominant slopes are 2 to 7 percent.

Principal Association Soils: Soils of the Pansan series are mostly associated with the Jeonnam, Gwangsan and Bancheon series.

Drainage and Permeability: Well drained. Runoff is medium and internal drainage is medium to slow. Permeability is slow.

Use and Vegetation: Most areas are used for nonflood irrigated crops such as barley, soybean, sweet potatoes, white potatoes, red pepper, and vegetables. Ginseong is grown especially on these soils.

Distribution and Extent: Soils of the Pansan series occur in association with the red granitic soils mainly in many small areas mostly in the south western part of Korea.

Series Established: Gwangsan Gun, Jeollanam Do, March 1967.

Remarks: Profile No. 202 from the Buyeo Gun survey is considered typic and may be classified as a Humic Hapludult except that the base saturation is somewhat high. The range of base saturation in this and similar residual granitic soils is mostly between 15 and 35 percent, however many profiles have base saturation between 35 and 60 percent. There appears to be no way at the present time to map the soils seperately at the 35 percent level. These series are therefore placed in the Typic subgroup and the 35 to 60 percent base saturation portion is considered as a taxonomic inclusion.

Lab. Nos. Cg231-236 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori-zon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 15	Ap	8.5	6.8	8.9	8.0	6.3	4.4	47.2	18.4	L	24.8	29.4	27.4	CL
15- 35	A1	1.2	7.3	8.6	7.6	6.9	4.6	48.7	16.3	L	24.6	29.8	29.3	CL
35- 60	B1t	0.2	3.0	3.3	3.1	2.8	2.0	52.3	33.5	SiCL	9.9	20.5	36.1	LiC
60-110	B2t	0.0	1.1	1.9	2.4	1.8	1.4	47.7	43.7	SiC	5.7	15.7	34.9	LiC
110-130	B31t	0.0	2.8	4.0	4.4	3.6	2.6	54.3	28.3	SiCL	11.7	20.5	39.5	LiC
130-150	B32t	-	-	-	-	-	-	-	-	-	-	-	-	-

Moisture Retention %			Bulk Density g/cc	pH		O.M. %	2/ CEC	Extractable Cations me/100g				
1/10 atms	1/3 atms	15 atms		H_2O (1:1)	1 N KCl			Ca	Mg	Na	K	H
33.6	23.4	8.1	-	5.5	3.9	1.81	8.30	1.70	0.95	0.05	1.68	-
35.2	22.6	8.2	1.14	4.7	3.5	1.24	7.80	1.00	0.65	0.05	0.35	-
36.7	27.0	13.4	1.35	5.1	3.8	1.19	11.50	3.80	1.75	0.18	0.43	-
37.7	29.0	17.1	1.39	5.3	3.9	1.00	14.10	4.50	2.70	0.20	0.25	-
-	-	-	-	5.7	3.9	0.32	8.90	2.65	1.85	0.15	0.25	-
28.3	22.2	8.2	-	5.4	3.9	0.16	7.10	1.45	1.25	0.13	0.20	-

Base Saturation %	
CEC	Sum of Cations
52.2	-
26.3	-
53.6	-
54.3	-
55.1	-
42.7	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KPJ, JFD
15 October, 1969

PONGGYE SERIES

The Ponggye series is a member of the fine clayey, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have thin brown to dark brown silty clay loam A horizons, deep yellowish red to red silty clay Bt horizons and strong brown loam C horizons. They are developed in hilly and mountainous areas underlaid by deeply weathered medium textured andesite porphyry and similar materials.

Typifying Pedon: Ponggye silty clay loam, eroded - forest (Field description Gimhae Gun profile No. 81; colors are for moist soil.)

A -- 0 to 8 cm. Brown to dark brown (7.5YR 4/4) silty clay loam; strong fine granular structure; friable, sticky and plastic; many fine and medium pine tree roots; few small angular gravel; clear smooth boundary; pH 4.5.

B21t -- 8 to 25 cm. Yellowish red (5YR 4/8) silty clay loam; moderate fine to medium subangular blocky and some moderate medium granular structure; patchy thin clay cutans; friable, sticky and plastic; common fine to medium pine tree roots; clear smooth boundary; pH 4.5.

B22t -- 25 to 57 cm. Red (2.5YR 4/6) silty clay; moderate medium and coarse subangular blocky structure; patchy thin clay cutans; firm, sticky and plastic; few fine random interstitial pores; few fine roots as above; diffuse smooth boundary; pH 5.0.

B31 -- 57 to 70 cm. Red (2.5YR 4/8) clay loam; moderate fine and medium subangular blocky structure; patchy thin clay cutans; firm, sticky and plastic; pores as above; few fine roots; clear smooth boundary; pH 5.0.

B32 -- 70 to 90 cm. Faintly mottled yellowish red (5YR 4/8), reddish yellow (5YR 7/6) and red (2.5YR 4/8) loam; crushed color yellowish red (5YR 5/8); weak coarse subangular blocky structure; friable, slightly sticky and plastic; gradual smooth boundary; pH 5.0.

C -- 90 to 120 cm. Prominently mottled reddish yellow (5YR 5/6), black (5YR 2/1) and yellowish red (5YR 5/6) loam, crushed color brown to strong brown (7.5YR 5/5); structureless (massive) breaking to weak blocky; friable, slightly sticky and slightly plastic; pH 5.0.

Type Location: Gimhae Gun, Gyeongsangnam Do, about 500 meters south of Cheon Ri, Ibug Myeon.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. Where severely eroded it may be somewhat less than 100 cm. Base saturation is less than 35 percent and reaction is strongly acid throughout. Less than 10 percent gravel and stones occur. A horizons are 10 to 20 cm. thick, dark brown, dark yellowish brown, brown or yellowish red where eroded, silt loam, silty clay loam or loam. Bt horizons are yellowish red, reddish yellow, reddish brown or red silty clay, clay or heavy clay loam. C horizons are reddish yellow, strong brown, brown or yellowish red loam, silt loam or very fine sandy loam moderately weathered mica free andesite porphyry saprolite. Depth to hard rock is variable, probably with wavy boundary, averaging about 2 to 5 meters.

Competing Series and Their Differentiae: These include the Dalcheon, Jeonnam, Gwangsan, Bancheon, Songjeong, Taehwa and Sirye series. The Dalcheon soils are moderately deep, contain more quartz grit and mica and are derived from granitic materials. The Jeonnam, Gwangsan and Songjeong soils have very deep granitic saprolite and contain mica throughout the profiles. The Bancheon soils have high base saturation and are formed in old alluvial materials. The Taehwa soils have more yellow colors, fine loamy textures and have moderately deep sola. The Sirye soils are moderately deep, have high base saturation and grayish brown shale parent materials.

Setting: The Bonggye soils occur on rolling to steep hilly and mountainous areas underlain by deeply weathered light colored andesite porphyry and similar rocks. Slopes range from 7 to 60 percent but dominant slopes are 15 to 30 percent.

Principal Associated Soils: The Mudeung, Taehwa, Ulsan and Samgag soils are associated. The Mudeung soils are shallow over hard bedrock, lack argillic B horizons and occur in more exposed landscape positions. The Taehwa soils generally occur on steeper rather smooth slopes. The Ulsan soils have coarse loamy textures and cambic B horizons. The Samgag soils occur in similar positions and are derived from granitic materials.

Drainage and Permeability: Well drained. Permeability is very slow and runoff is medium or rapid depending on the slope.

Use and Vegetation: Most areas grow pine forest, however some areas are cultivated for red pepper, sesame, melon, potatoes, barley and similar crops.

Distribution and Extent: The Bonggye soils are of small extent, in hilly areas with andesite porphyry geology.

Series Established: Ulju Gun, Gyeongsangnam Do, 1967

Remarks

Bonggye Series Contd.

Lab. Nos. G1157-161 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 8	A	4.8	1.7	3.3	2.7	2.3	2.6	53.8	33.6	SiCL	8.1	17.8	40.5	LiC
8-25	B21t	0.6	—	5.5	—	1.9	1.5	50.6	40.5	SiC	5.9	14.4	39.2	LiC
25-57	B22t	0.0	—	7.5	—	1.1	3.7	41.0	46.7	SiC	7.9	13.9	31.5	HC
57-70	B31	0.3	2.2	3.7	4.5	5.5	7.3	46.0	30.8	CL	11.3	28.6	30.8	LiC
70-90	B32	0.0	2.7	4.7	7.0	9.3	12.5	48.5	15.3	L	15.2	42.8	26.7	CL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH: H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H
41.8	32.2	15.2	1.20	5.1	3.8	1.77	9	9.60	0.10	0.00	0.59	0.23	5.23
41.2	31.4	17.9	1.20	5.3	3.8	1.14	3	10.20	0.00	0.10	0.15	0.15	5.73
45.1	36.4	19.7	1.27	5.8	3.8	0.31	3	11.90	0.05	0.05	0.12	0.10	7.29
56.5	44.6	20.9	1.15	5.4	3.7	0.32	3	13.05	0.05	0.35	0.15	0.08	7.94
58.6	45.7	16.0	-	5.4	3.8	0.26	-	12.40	0.00	1.35	0.08	0.17	-

Base Saturation %: CEC	Sum of Cations
60.0	-
66.0	-
71.0	-
87.0	-
72.0	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
KPJ, UKT, JFD
30 October, 1969

PONGNAM SERIES

The Pongnam series is a member of the fine clayey, mixed, nonacid, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick gray silty clay loam Apg horizons and moderately deep gray silty clay or clay cambic Bg horizons underlain by thick highly organic fine clayey mineral layers 20 to 50 cm. thick over very deep stratified greenish gray silty clay or silty clay loam Cg horizons in alluvium on broad level fluvio-marine plains.

Typifying Pedon: Pongnam silty clay loam - rice (Field description Gimje Gun profile No. 111; colors are for moist soil.)

Ap1g -- 0 to 12 cm. Gray (5Y 5/1) silty clay loam; many fine to medium prominent strong brown (7.5YR 5/6) and common medium prominent yellowish red (5YR 4/8) mottles; puddled; coarse prismatic structure when dry, breaking to weak medium granular; firm, sticky and plastic; many fine to medium discontinuous random inped dendritic vesicular pores; many very fine mica; many fine to medium living and dead roots; abrupt smooth boundary; pH 5.0.

Ap2g -- 12 to 22 cm. Gray to grayish brown (10YR 5/1.5) silty clay loam; many coarse faint brown to dark brown (7.5YR 4/4) and common fine to medium distinct yellowish red (5YR 4/8) mottles; crushed color grayish brown to dark grayish brown (10YR 4.5/2); weak coarse platy structure; firm, sticky and plastic; fine to medium discontinuous random inped and exped simple dendritic vesicular and tubular pores; common very fine mica; roots as above; clear smooth boundary; pH 5.5.

B1g -- 22 to 45 cm. Gray to light gray (10YR 6.5/1) silty clay; many fine to coarse distinct yellowish brown (10YR 5/8) mottles; moderate medium to coarse prismatic structure; very firm, sticky and plastic; moderately thick continuous clayey cutans; many fine inped and exped simple tubular pores; common very fine mica; common roots as above; diffuse smooth boundary; pH 6.0.

B2g -- 45 to 68 cm. Gray (10YR 5/1) silty clay; many coarse prominent reddish brown (5YR 4/4) and coarse distinct brown to dark brown (7.5YR 4/4.5) mottles; few Mn concretions; crushed color brown to dark brown (10YR 4/3); moderate coarse prismatic structure; firm, very sticky and very plastic; moderately thick continuous clayey cutans; pores as above; roots as above; gradual smooth boundary; pH 6.0.

C1g -- 68 to 84 cm. Black (10YR 2/1) clay; structureless (massive); firm, sticky and plastic; common simple tubular pores; few undecomposed fibrous grass and reed stems; few dead roots; clear smooth boundary; pH 6.6.

C2g -- 84 to 112 cm. Very dark brown (10YR 2/1) silty clay loam; structureless (massive); pores as above; high organic matter content; no roots; clear smooth boundary; pH 6.5.

C3g -- 112 to 180 cm. Light greenish gray (7.5GY 7/1) silty clay; many fine to medium prominent brown to dark brown (7.5YR 4.5/4) mottles; structureless (massive); sticky and plastic; many fine to coarse continuous tubular pores; common fine to medium undecomposed dead roots; pH 6.5.

Type Location: Gimje Gun, Gyeongsangnam Do, about 150 meters east of Hagdong Ri, Baeggu Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is probably greater than 5 meters. A black to very dark brown highly organic mineral layer ranging from 20 to 50 cm. thick occurs between 50 and 100 cm. depths. Base saturation is more than 60 percent. Reaction ranges from strongly acid to neutral and increases with depth. Few to common mica flakes are present. The Apg horizons are moderately thick gray, grayish brown, dark grayish brown or dark gray silty clay loam or silt loam with common distinct or prominent mottles. Clay loam Apg horizons sometimes occur near granite hills. The cambic Bg horizons are dark gray, gray, grayish brown, dark grayish brown or light gray silty clay, clay or heavy silty clay loam with 10YR or 2.5Y hues and common or many distinct or prominent dark yellowish brown, dark reddish brown, yellowish red or strong brown mottles. The peaty and mucky mineral layers, with 3 to 20 percent organic matter, are black to very dark grayish brown or very dark brown silty clay or clay with few faint or no mottles. The Cg horizons beginning below 100 cm., are greenish gray, dark greenish gray, dark gray or very dark gray silty clay loam to silty clay with hues of 5Y or less.

Competing Series and Their Differentiae: These are the Gongdeog, Gimje, Buyong and Suggye series. The Gongdeog soils have thicker (50-100 cm.) peaty layers. The Gimje soils have thinner (10-20 cm.) peaty and mucky layers. The Buyong soils lack peaty or mucky layers. The Suggye soils belong to the fine silty texture family, have less distinct mottles and lack peaty or mucky layers.

Setting: The Pongnam soils occur in alluvium on level fluvio-marine plains. Dominant slopes are 0 to 1 percent and the slope range is from 0 to 2 percent.

Principal Associated Soils: The Jeonbug, Gimje, Buyong, and Gongdeog soils are associated in similar physiographic positions. The Jeonbug soils lack organic mineral layers and belong to the fine silty texture family.

Drainage and Permeability: Poorly drained, very slowly permeable mineral layers and very slow to ponded runoff. Depth to the watertable is about 10 to 25 cm. except where artificially controlled.

Use and Vegetations: The Pongnam soils are used entirely for flood irrigated rice. Some of the better artificially drained areas are also used for barley or wheat.

Distribution and Extent: The Bongnam soils are of small extent and are distributed mainly on the west and south coastal areas of the country.

Series Established: Gimje Gun, Jeollabug Do, 1966.

Remarks: The clay increase in the Bg horizon is due to stratification. The prismatic structure with clayey cutans is considered as due largely to seasonal shrinking and swelling and subsequent accumulation of Apg material on the prism faces. If the Bg horizons were argillic, these soils would belong to the Typic Ochraqualf Subgroup. The drainage of this series was considered as imperfect before placement in the new classification system because double crops can be grown.

Lab. Nos. Dm240-246 **Typifying Pedon**

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori-zon	Gra-vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 12	Ap1g	1.5	1.4	2.8	2.4	2.8	2.7	55.1	32.8	SiCL	7.2	13.9	46.1	SiC
12- 22	Ap2g	0.0	1.7	2.6	2.3	2.3	2.0	54.8	34.3	SiCL	7.1	16.4	42.2	LiC
22- 45	B1g	0.0	——	0.6	——	0.6	0.6	46.2	52.0	SiC	0.7	3.1	44.2	HC
45- 68	B2g	0.0	——	0.2	——	0.4	0.6	50.5	48.3	SiC	0.3	9.1	42.3	HC
68- 84	C1g	0.0	——	0.1	——	0.2	0.1	25.3	74.3	C	0.2	2.2	23.3	HC
84-112	C2g	0.0	——	0.5	——	0.5	0.4	62.6	36.0	SiCL	0.6	8.0	55.4	SiC
112-180	C3g	0.0	——	0.4	——	0.5	0.4	54.5	44.2	SiC	0.5	25.1	30.2	LiC

Moisture Retention %			Bulk	pH		O.M.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	Density g /cc	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
51.9	46.7	24.9	-	4.7	4.1	3.16	13.10	3.88	2.00	0.27	0.17	1.62	48.2	79.6
45.4	39.9	22.4	1.37	5.5	4.8	2.10	11.90	5.62	3.50	0.25	0.12	0.15	79.7	98.4
45.5	39.7	24.3	1.04	6.5	5.6	2.34	14.15	7.12	5.00	0.27	0.12	0.15	88.4	98.8
48.2	42.4	27.0	-	5.5	4.9	1.13	17.40	7.50	5.75	0.50	0.15	0.10	79.9	99.3
52.3	45.9	26.7	0.90	5.1	4.7	10.11	32.60	11.87	7.50	0.57	0.20	1.15	61.2	94.5
56.9	50.1	29.4	-	5.2	4.6	20.01	39.05	13.00	7.25	0.65	0.17	1.15	54.0	94.8
41.4	35.3	13.9	-	5.5	4.5	0.59	14.00	5.62	4.62	0.35	0.27	0.35	77.6	96.9

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KPJ, JFD
3 November, 1969

BONGRIM SERIES

The Bongrim series is a member of fine silty, mixed, acid, mesic family of fluventic Haplaquepts (low-Humic Gley soils). These soils have thin dark grayish brown silty clay loam Apg horizons and gray moderately thick silty clay loam cambic Bg horizons with many yellow iron sulfate mottles and very strongly acid reaction. Cg horizons are dark gray silty clay loam with few or no mottles and near neutral reaction. They are developed in slightly depressed positions on broad fluvio-marine plains.

Typifying Pedon: Bongrim silty clay loam - rice (Field description Gimhae Gun profile No. 5; colors are for moist soil.)

Apg -- 0 to 10 cm. Grayish brown (2.5Y 5/2) silty clay; many medium to coarse distinct strong brown (7.5YR 5/6) mottles; puddled structure (massive); friable, sticky and plastic; many dead rice roots; abrupt smooth boundary; pH 4.7.

B1g -- 10 to 30 cm. Grayish brown (2.5Y 5/2) silty clay loam; common coarse prominent dusky red (2.5YR 3/2), medium to fine prominent yellowish red (5YR 4/6) and medium prominent yellow (10YR 7/6) mottles along common semidecayed reed stems and roots; weak coarse prismatic structure; firm, sticky and plastic; clear smooth boundary; pH 4.9.

B2g -- 30 to 48 cm. Dark gray (5Y 4/1) silty clay loam; few medium to coarse distinct light olive brown (2.5Y 5/4) mottles along common semidecayed reed stem and root channels; weak coarse prismatic structure; firm, sticky and plastic; less reed stems than above; clear smooth boundary; pH 5.0.

Cg -- 48 to 120 cm. Dark gray to very dark gray (5Y 3.5/1) silty clay loam; no mottles; structureless (massive); common very fine white and yellow mica; no reed stems or roots; very few fine shells; pH 8.0.

Type Location: Gimhae Gun, Gyeongsangnam Do, about 100 meters south Hwamog Gu, Garag Myeon.

Range in Characteristics: Solum thickness ranges from 20 to 50 cm. and depth to hard rock is probably greater than 5 meters. Base saturation is more than 60 percent throughout the profiles. Solum reaction is strongly to extremely acid except where limed and Cg horizons are neutral to mildly alkaline. The Apg horizons are 10 to 20 cm. thick, grayish brown, gray and dark grayish brown silty clay loam, light silty clay or silt loam. Cambic Bg horizons are gray, grayish brown or light brownish gray silty clay loam or heavy silt loam with semidecayed reed stems and roots and many or common prominent yellowish red or dark red mottles and concentrations of yellow iron sulfates. The control section contains more than 60 percent silt and less than 35 percent clay. Cg horizons are dark gray, dark grayish brown, very dark gray or dark olive gray silty clay loam or heavy silt loam. Thin strata of similar textures may occur. These soils are formed in recently reclaimed only slightly leached tidal marsh and tidal flat fine silty and fine loamy fluvio-marine alluvial materials.

Competing Series and Their Differentiae: These are the Deunggu, Gimhae, Hagseong and Heacheog soils. The Deunggu soils have weakly stratified coarse loamy Cg horizons and less acid solum reaction. The Gimhae soils have very strongly acid sola, thicker cambic Bg horizons with more prominent mottles and poor drainage. The Heacheog soils have stratified coarse loamy Cg horizons. The Hagseong soils have fine silty over sandy textures.

Setting: The Bongrim soils occur in slight depressions in broad fluvio-marine plains and are derived from alluvial materials.

Principal Associated Soils: In addition to the competing soils, the Suggye and Buyong series may be associated. The Suggye and Buyong soils are less acid and free of yellow iron sulfate mottles. The Suggye soils are developed on continental alluvial plains and the Buyong soils have fine clayey textures.

Drainage and Permeability: Very poorly drained. Permeability is slow and runoff is very slow or ponded. The ground water table is in or near the surface during most seasons. Artificial drainage systems are mostly only recently established and in most areas are poorly developed.

Use and Vegetation: Most of these soils are used only for flood irrigated rice. Some areas, not yet reclaimed, have wild marsh reed and grass vegetation.

Distribution and Extent: The Bongrim soils are of small extent and occur on recently or nonreclaimed fluvio-marine plains. The known areas occur along the southern coast.

Series Established: Gimhae Eup, Gimhae Gun, Gyeongsangnam Do, April 1968.

Remarks: Bongrim is one of the so called Acid Sulfate soils in Korea on fluvio-marine plains in which the reaction decreases about 1.0 on drying. It may also be considered as fine silty extremely acid shallow over neutral weakly stratified raw alluvium. The sulphur content is less than 2.0 in the Final Report of Dr. B. C. Deb, Soil Chemist, UNKSOF, 1968.

Lab. Nos. G16-9 **Typifying Pedon**

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	Apg	0.0	-	1.0	-	0.8	1.3	52.7	44.2	SiC	1.1	6.7	48.0	SiC
10- 30	B1g	0.0	-	1.3	-	0.9	1.7	59.7	36.4	SiCL	1.4	13.5	48.7	SiC
30- 48	B2g	0.0	-	0.7	-	0.4	2.7	85.6	30.6	SiCL	0.8	16.3	52.3	SiC
48-120	Cg	0.0	-	0.5	-	1.3	6.3	63.0	28.9	SiCL	0.6	24.0	46.5	SiC

Moisture Retention %			pH		O.M.	Avail.	Free	2/	Extractable Cations				
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	Fe_2O_3 %	CEC	Ca	Mg	Na	K	H
									me/100g				
71.4	58.1	41.0	3.9	3.4	5.96	10	3.29	10.4	2.20	6.65	3.45	0.80	4.71
55.3	44.4	31.7	3.9	3.3	2.18	19	1.83	14.6	1.95	6.00	2.40	0.70	5.90
47.5	39.6	22.4	5.8	4.8	3.08	34	0.99	12.3	4.35	8.30	3.40	0.93	3.52
45.7	37.2	24.3	7.2	6.6	3.28	63	0.97	14.1	5.80	9.60	4.30	1.15	0.05

Base Saturation %	
CEC	Sum of Cations
125.9	73.6
75.7	65.6
138.0	82.8
147.9	99.8

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
20 October, 1969

BONRYANG SERIES

The Bonryang series is a member of the coarse loamy over sandy, mixed, mesic family of Typic Udifluvents (Alluvial soils). These soils have thin brown sandy loam Ap horizons, moderately thick brown to dark brown sandy loam upper substrata and very deep stratified brown gravelly loamy sand or gravelly sand lower substrata. They are formed in stratified alluvium on broad continental alluvial plains.

Typifying Pedon: Bonryang sandy loam - barley (Field description Damyang Gun profile No. 13; colors are for moist soil.)

Ap -- 0 to 20 cm. Dark brown (10YR 3/3) sandy loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; common fine living roots; abrupt smooth boundary.

A1 -- 20 to 44 cm. Brown to dark brown (10YR 4.5/3) sandy loam; structureless (massive) breaking to fine and medium granular structure; friable, slightly sticky and slightly plastic; few fine living roots; gradual wavy boundary.

C1 -- 44 to 60 cm. Brown to dark brown (10YR 4/3) sandy loam; structureless (massive) breaking to medium granular; friable, slightly sticky and slightly plastic; abrupt wavy boundary.

C2 -- 60 to 100 cm. Brown (10YR 5/3) fine gravelly loamy coarse sand; structureless (single grain); loose, nonsticky and nonplastic; approximately 20 percent fine quartz gravel.

Type Location: Damyang Gun, Jeollanam Do, about 500 meters west of Sanggye bridge, Sanggye Ri, Bongsan Myeon.

Range in Characteristics: Soil depth is greater than 150 cm. and depth to hard rock is generally more than 5 meters. Base saturation is more than 60 percent in the control section. Reaction is strongly to medium acid except where limed, increasing slightly with depth. Ap horizons are thin to moderately thick brown, dark brown or dark yellowish brown (yellowish brown or pale brown when dry) sandy loam, fine sandy loam or loam. The upper C horizons are moderately deep brown to dark brown, brown, pale brown, yellowish brown, dark yellowish brown, brownish yellow or light yellowish brown sandy loam, coarse sandy loam, fine sandy loam or loam with less than 18 percent clay and a few gravel pieces. The lower C horizons below 50 to 100 cm. are dark yellowish brown, yellowish brown, pale brown, brown, or light yellowish brown gravelly loamy coarse sand, sand or loamy sand.

Competing Series and Their Differentiae: These are the Nagdong, Hwabong, Jungdong, Ihyeon and Hwangyong series. The Nagdong and Jungdong soils have finer substrata textures and are gravel free. The Hwabong soils have sandy textures. The Ihyeon soils have coarse silty textures throughout. The Hwangyong soils are in the sandy skeletal texture family.

Setting: The Bonryang soils are on level to nearly level broad alluvial plain river levees in stratified coarse textured continental alluvial materials. Dominant slopes are about one percent and slope range is less than 3 percent.

Principal Associated Soils: The Nagdong, Hwabong, Jungdong and Hwangyong soils are associated in similar physiographic positions.

Drainage and Permeability: Well drained. Runoff is moderately slow to slow and permeability is rapid to moderately rapid.

Use and Vegetation: Most areas are used for upland crops such as peanuts, cabbage, spinach, squash, melon, lettuce, spanish lettuce, eggplant and similar nonirrigated crops.

Distribution and Extent: The Bonryang soils are of moderate extent and are distributed on alluvial plains adjacent to river channels throughout the granitic areas of the country.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Remarks: The typifying pedon A horizon is thicker than normal for the series.

Lab. Nos. Ee45-48 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 20	Ap	6.7	5.8	10.4	17.2	14.3	12.6	29.8	9.9	SL	36.0	37.2	16.9	SL
20- 44	A1	7.2	4.3	9.2	13.3	14.9	17.0	32.3	9.0	SL	29.0	44.1	17.9	FSL
44- 60	C1	6.2	5.8	10.8	14.8	13.6	15.0	30.9	9.1	SL	33.7	40.1	17.2	FSL
60-100	C2	19.0	16.5	25.0	23.7	10.6	6.1	12.8	5.3	LCoS	67.8	19.6	7.3	LCoS

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	18.1	6.3	5.2	4.0	2.28	6.10	2.88	2.80	0.10	0.15	0.30	64.4	92.9
	20.8	6.7	5.1	3.7	2.48	6.70	2.22	0.42	0.05	0.10	1.51	41.6	64.9
	20.5	6.1	5.4	3.9	1.62	6.05	2.88	0.40	0.05	0.08	0.65	56.4	84.0
	9.5	3.5	5.9	4.4	1.34	3.00	1.80	0.30	0.05	0.08	0.10	74.3	67.0

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
30 October, 1969

BUYEO SERIES

The Buyeo series is a member of the fine loamy, mixed, mesic family of Typic Hapludalfs (Red-Yellow Podzolic soils with high base saturation). These soils have thin reddish brown loam Ap or A1 horizons and moderately deep red silt loam or loam argillic B horizons. The C horizons are red silt loam or loam strongly weathered reddish brown sedimentary materials over hard consolidated residuum. They occur on rolling and hilly uplands.

Typifying Pedon: Buyeo rocky loam, eroded - pine forest (Modified field description Buyeo Gun profile No. 205; colors are for moist soil.)

A --- 0 to 8 cm. Reddish brown (2.5YR 4/4) loam; moderate fine granular structure; friable, sticky and plastic; many fine and coarse pine tree and wild grass roots; abrupt smooth boundary.

B1t --- 8 to 25 cm. Red (2.5YR 4/6) loam; weak coarse subangular blocky structure; firm, sticky and plastic; few fine living pine tree roots; clear smooth boundary.

B2t --- 25 to 52 cm. Reddish brown (2.5YR 4/4) silt loam; weak medium subangular blocky structure; firm, sticky and plastic; horizontal and oblique white (2.5YR 8/0) and reddish brown (2.5YR 4/4) clayey and silty cutans; clear irregular boundary.

C1 --- 52 to 85 cm. Weak red (10Y 4/4) silt loam; structureless (massive); strongly weathered siltstone; firm, sticky and plastic; few medium and coarse black (5YR 2/1) Mn concretions; fine strongly weathered white feldspar grains; clear smooth boundary.

C2 --- 85 to 110 cm. Weak red (10R 4/3) very firm partly weathered red siltstone and shale materials, can be cut with spade with difficulty.

Type Location: Buyeo Gun, Chungcheongnam Do, about 150 meters west of Insae Primary School, Insae Ri, Saedo Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard bedrock ranges from 100 to 150 cm. Up to 90 percent bedrock outcrops and some gravel may occur. The argillic B horizon averages between 20 to 30 percent clay and 30 to 60 percent silt. Base saturation is medium (35 to 60 percent) in the solum and increases to more than 60 percent in the C horizon. Reaction is strongly to medium acid throughout the profile except where limed. A1 or Ap horizons range up to 20 cm. thick, depending on erosion, are reddish brown, dark reddish brown, weak red, red or dusky red loam, silt loam or silty clay loam. The moderately deep Bt horizons are reddish brown, weak red, dusky red or dark reddish brown silt loam, loam or silty clay loam with weakly or moderately developed subangular blocky structure and thin clayey cutans. C horizons have similar colors, loam, silt loam, silty clay loam or fine sandy loam textures and generally contain less than 18 percent clay. C horizons are formed in rather shallow weathered reddish brown consolidated residual stratified sedimentary materials.

Competing Series and Their Differentiae: These are the Sirye, Songjeong, Habin, Daegu, Mudeung and Jeongja soils. The Sirye soils have fine clayey Bt horizons, and are derived from grayish brown shale materials. The Songjeong soils contain mica throughout the profile, have less brown colors and are derived from granitic materials. The Habin soils have coarse loamy textures and are shallow over hard bedrock. The Daegu and Mudeung soils have lighter colors and hard bedrock within 50 cm. of the surface. The Jeongja soils have similar colors and hard gabbro bedrock within 50 cm. of the surface.

Setting: The Buyeo soils are formed on rolling, hilly and steep relief mostly at relatively low elevations above valley floors in residuum derived from reddish brown shale, fine grained sandstone, mudstone and some conglomerate materials. Slope ranges from 2 to 60 percent with 2 to 15 percent slopes dominating.

Principal Associated Soils: These soils are associated with the Samam and Habin series. The Samam soils are formed in local alluvium in narrow local valleys in soil materials washed from the Buyeo and Habin soils.

Drainage and Permeability: Well drained. Permeability is moderate to slow and runoff is moderate or rapid depending on the slope.

Use and Vegetation: Most of these soils are now in degraded pine forest and wild grass. Some areas are used for sweet potato, barley, soybean, tobacco and similar crops.

Distribution and Extent: The Buyeo soils are of small extent and are distributed in the south western and south central parts of the country.

Series Established: Buyeo Gun, Chungcheongnam Do, 1968.

Remarks: Owing to stratification of the sedimentary parent materials these soils have considerable local variation. Soil colors are largely inherited from the parent materials.

Lab. Nos. Cg248-252 Typifying Pedon

Depth cm	Hori-zon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
0- 8	A	5.0	4.9	8.8	8.8	5.8	4.0	48.6	19.1	L	23.6	28.8	28.5	CL
8- 25	B1t	3.7	11.3	8.7	7.5	5.5	4.5	39.1	23.4	L	28.4	23.9	24.3	CL
25- 52	B2t	0.0		5.9		4.0	5.7	58.2	26.2	SiL	6.4	29.9	37.5	LiC
52- 85	C1	0.0	2.6	4.9	5.8	5.3	6.5	59.7	15.2	SiL	14.2	38.1	32.5	CL
85-110	C2	0.0	3.9	7.7	11.3	11.6	20.8	47.5	7.2	L	24.5	45.1	23.2	FSL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H_2O (1:1)	pH 1 N KCl	O.M. %	CEC 2/ me/100g	Ca	Mg	Na	K	H	Base Sat. CEC	Base Sat. Sum of Cations
								Extractable Cations me/100g						
34.5	25.7	11.9	-	5.2	3.8	2.13	9.9	2.30	1.45	0.10	0.28	-	41.7	-
30.8	22.5	11.7	1.40	5.2	3.6	0.53	9.1	1.60	1.65	0.08	0.15	-	38.2	-
32.9	26.0	12.2	1.52	5.2	3.7	0.19	13.5	3.85	2.90	0.15	0.13	-	59.5	-
33.7	25.4	8.9	-	5.3	3.9	0.06	10.5	5.25	3.15	0.28	0.13	-	82.7	-
30.5	20.3	5.8	-	5.3	4.0	0.04	7.4	3.80	2.10	0.23	0.13	-	84.6	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
31 October, 1969

BUYONG SERIES

The Buyong series is a member of the fine clayey mixed, nonacid, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick grayish brown silt loam Ag horizons, very thick gray to dark gray prominently mottled silty clay Btg horizons and greenish gray silty clay to clay Cg horizons with neutral reaction. They are formed in moderately leached areas of reclaimed fluvio-marine plains.

Typifying Pedon: Buyong silt loam - rice paddy (Field description Gimje Gun profile No. 15; colors are for moist soil.)

Ap1g -- 0 to 12 cm. Grayish brown (5Y 5/2) silt loam; puddled structure, breaking in part to weak fine and medium granular and some blocky; common fine to medium prominent strong brown (7.5YR 5/6) mottles; friable, sticky and plastic; few fine and very fine pores; few fine and very fine white and yellow mica flakes; abundant fine dead rice roots; abrupt smooth boundary.

Ap2g -- 12 to 20 cm. Dark grayish brown (2.5Y 4/2) silt loam; weak medium to coarse platy structure; common medium to fine prominent yellowish red (5YR 5/6) mottles; firm, sticky and plastic; common fine to medium pores; mica as above; common fine dead rice roots; clear smooth boundary.

B1g -- 20 to 35 cm. Dark gray (5Y 4/1) silt loam; weak coarse prismatic structure, breaking to weak medium subangular blocky; many fine to coarse prominent dark red (2.5YR 3/6) mottles; firm, sticky and plastic; common fine pores; mica as above; few fine dead rice roots; clear smooth boundary.

B21g -- 35 to 48 cm. Gray (5Y 5/1) silty clay loam; moderate coarse prismatic structure, breaking to moderate medium and coarse subangular blocky and fine weak and medium angular blocky; continuous moderately thick clayey cutans on prisms and some peds; many medium to coarse distinct light olive brown (2.5Y 5/6) mottles; firm, sticky and plastic; common fine to medium pores; mica as above; no roots; clear smooth boundary.

B22g -- 48 to 63 cm. Very dark gray (2.5Y N3/) silty clay; moderate medium to coarse prismatic structure, breaking to moderate medium and coarse subangular blocky; many coarse prominent yellowish brown (10YR 5/8) mottles; clayey cutans as above; firm, very sticky and very plastic; few fine pores; mica as above; clear wavy boundary.

B3g -- 63 to 100 cm. Dark gray (2.5Y N4/) silty clay; coarse prismatic structure diminishing with depth; clayey cutans as above; common coarse distinct olive brown (2.5Y 5/6) mottles; firm, very sticky and very plastic; few medium pores; mica as above; clear smooth boundary.

C1g -- 100 to 180 cm. Gray (2.5Y N5/) silty clay; structureless (massive); few fine to medium distinct yellowish brown (10YR 5/6) mottles; firm, sticky and plastic; no pores; mica as above; no samples taken.

Type Location: Gimje Gun, Jeollabug Do, approximately 100 meters west of the Buyong Railway Station, Buyong Ri, Baeggu Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. averaging about 80 cm. Reaction is slightly acid to neutral throughout the control section increasing with depth to neutral in the Cg horizon. The Apg horizons are grayish brown, olive gray, dark gray or dark grayish brown silt loam or silty clay loam with distinct or prominent yellowish brown, yellowish red or strong brown mottles. Reaction of the Apg horizons is strongly to medium acid except where limed. The Bg horizons are gray to dark gray, olive gray, grayish brown or dark grayish brown heavy silty clay loam, silty clay or clay with many prominent strong brown, yellowish red, yellowish brown or brown to dark brown mottles. Clay content of the Bg horizons is more than 35 percent. The Cg horizons are gray, dark gray, greenish gray or bluish gray silty clay or silty clay loam unleached fluvio-marine strata with few distinct or prominent reddish yellow, yellowish brown, strong brown or yellowish red mottles and neutral to mildly alkaline reaction. Black peaty mineral soil sometimes occurs below 150 cm. The Buyong soils are formed in reclaimed recent fluvio-marine deposits. When drained and during dry seasons, the soil cracks in a prismatic structural pattern to water table depths. When irrigated the following season, some clayey and silty surface soil materials penetrate among the prisms forming coatings on the prism surfaces. Clay increases with depth are largely due to stratification.

Competing Series and Their Differentiae: These are the Bongnam, Gimje and Honam series. The Bongnam and Gimje soils have peaty and mucky mineral horizons within 50 to 100 cm. of the surface. The Honam soils are slightly more acid in reaction and are formed in alluvium on low terraces on broad continental alluvial plains.

Setting: The Buyong soils are on level to nearly level broad fluvio-marine plains. Slopes range from 0 to 2 percent, mostly less than 1 percent.

Principal Associated Soils: These are the Gimje, Bongnam, Jeonbug and Gongdeog soils on fluvio-marine plains. The Buyong soils are near the sea while these associated soils are farther inland.

Drainage and Permeability: Poorly drained. Permeability is very slow. Runoff is ponded or very slow. Depth to the water table is about 10 to 25 cm. except where artificially controlled.

Use and Vegetation: Most areas of these soils are used for flood irrigated rice paddy during the wet summers and, where sufficiently artificially drained, for nonirrigated barley during the dry winter months.

Distribution and Extent: The Puyong soils are of small extent and are distributed in the south and southwest coastal plain areas.

Series Established: Gimje Gun, Jeollabug Do, Puyong Ri, Baeggu Myeon, May 1966.

Remarks: The Buyong soils have been reclaimed for tidal flats and leached to depths of about 50 to 100 cm. The drainage of this series was considered as imperfect before placement in the new classification system because double crops can be grown.

Lab. Nos. Dm10-15 **Typifying Pedon**

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 12	Ap1g	1.2		6.9		3.3	1.5	61.4	26.9	SiL	7.7	21.5	43.9	LiC
12- 20	Ap2g	1.8		8.1		4.0	2.1	58.9	26.9	SiL	9.0	23.1	41.0	LiC
20- 35	B1g	1.8		8.6		4.3	2.5	59.0	25.6	SiL	9.5	21.9	43.0	LiC
35- 48	B21g	0.2		1.9		0.8	0.5	59.4	37.4	SiCL	2.1	14.6	45.9	SiC
48- 63	B22g	0.0		0.3		0.2	0.2	54.8	44.5	SiC	0.3	8.0	47.2	SiC
63-100	B3g	0.0		0.2		0.2	0.1	52.7	46.8	SiC	0.3	6.7	46.2	HC

Moisture Retention %			pH		O.M.	Free	2/	Extractable Cations					Base	Saturation %
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	Fe_2O_3 %	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
	37.7	11.6	4.7	3.9	2.50	1.30	7.75	2.12	1.35	0.20	0.10	1.85	48.6	67.1
	34.5	11.4	4.9	4.0	2.48	1.18	8.25	1.62	0.85	0.22	0.15	-	34.4	-
	33.2	11.2	5.1	4.2	2.48	0.96	8.30	3.38	2.12	0.25	0.08	0.62	70.2	90.4
	31.5	16.9	6.1	5.1	0.84	2.42	12.20	5.12	4.88	0.27	0.10	0.10	85.0	99.1
	34.9	17.5	6.2	5.2	0.75	1.84	16.60	6.62	7.50	0.40	0.17	0.10	88.5	99.3
	39.7	20.1	6.4	5.1	0.60	1.16	20.20	7.25	10.50	1.05	0.25	0.10	94.3	99.5

1/ Pipette Method, Sodium Hexameta - phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KPJ, JFD
23 June, 1969

CHAHANG SERIES

The Chahang series is a member of the fine loamy, mesic family of Typic Haplumbrepts (Acid Brown Forest soils). These soils have moderately thick very dark brown loam A horizons and very thick yellowish brown or dark yellowish brown silt loam cambic B horizons. The C horizons are yellowish brown silt loam or loam granitic saprolite.

Typifying Pedon: Chahang loam - corn (Field description Pyeongchang Gun profile No. 22; colors are for moist soil.)

Ap -- 0 to 12 cm. Very dark grayish brown (10YR 3/2) dry, very dark brown (10YR 2/2) moist, loam; fine to medium granular structure; friable, slightly sticky and slightly plastic; few fine yellow mica flakes; many fine to medium grass roots; diffuse smooth boundary; pH 5.5.

A1 -- 12 to 52 cm. Very dark brown (10YR 2/2) loam; weak coarse subangular blocky structure breaking readily to moderate fine and medium granular; friable, slightly sticky and slightly plastic; few fine yellow mica flakes; few fine worm holes and worm casts; common fine to medium grass roots; gradual wavy boundary; pH 5.7.

B1 -- 52 to 91 cm. Brown to dark brown (10YR 4/3) light silty clay loam; weak coarse subangular blocky structure breaking to medium and fine subangular blocky and moderate medium and fine granular; friable, slightly sticky and slightly plastic; few fine pores; mica as above; no roots; clear irregular boundary; pH 5.5.

B2 -- 91 to 110 cm. Yellowish brown (10YR 5/6) light clay loam; moderate coarse subangular blocky structure breaking to medium and fine subangular and granular; firm, slightly sticky and slightly plastic; common fine yellow mica flakes; few unweathered subangular granite cobbles and stones; gradual wavy boundary; pH 5.3.

B3 -- 110 to 140 cm. Yellowish brown (10YR 5/4) loam; weak subangular blocky structure breaking readily to granular; friable, slightly sticky and slightly plastic; gradual wavy boundary.

C1 -- 140 to 150 cm. Pale brown (10YR 6/3) loam and silt loam consisting of very deep strongly weathered friable granitic saprolite.

Type Location: Pyeongchang Gun, Gangweon Do, about 300 m. to the west of the Chahang Ri, Jinbu Myeon.

Range in Characteristics: The solum thickness ranges between 100 cm. and 150 cm. over very deep strongly weathered granitic saprolite. Thickness of the dark colored A horizon ranges from 20 to 50 cm. depending on the landscape position and averages about 25 cm. Few to common fine yellow mica occur throughout these soils. Reaction is strongly to medium acid and the base saturation is low, except for medium in the A horizon. Organic matter content in the A horizon is 2 to 10 percent. Ap or A1 horizons are very dark brown, very dark grayish brown and black loam or silt loam. Cambic B horizons are yellowish brown and strong brown silt loam, loam, light clay loam and silty clay loam. The C horizons are yellowish brown, strong brown or pale brown very fine sandy loam, loam or silt loam with few quartz grit and fine yellow mica.

Competing Series and Their Differentiae: These are the Sinbul, Mangsil, Weoljeong and Songjeong soils. The Sinbul soils are in the loamy-skeletal texture family while the Mangsil soils are in the clayey family and the Weoljeong soils are in the coarse loamy family. The Songjeong soils are similar except for lacking the dark A horizons, having yellowish red argillic B horizons and being at lower elevations.

Setting: The Chahang series occurs on hilly, rolling and moderately steep rather stable landscapes mostly above 600 meters elevation. Slopes range from 7 to 60 percent but 7 to 30 percent slopes dominate. The climate is cool and moist with a relatively short growing season of approximately 170-180 days.

Principal Associated Soils: The soils of the Weoljeong, Odae, Mui and Wangsan series are associated with the Chahang series. The coarse loamy Weoljeong soils are on similar but more exposed physiography while the shallow rocky Odae soils are on somewhat steeper slopes, usually on upper mountain sides and mountain tops. The Mui soils are associated in dissected mountain colluvium in somewhat lower landscape positions. The Wangsan soils are on dissected river terraces. The Imog soils occur in small valley local alluvium.

Drainage and Permeability: Well drained. Permeability is moderate and runoff is slow to medium owing to thick dark A horizons.

Use and Vegetation: These soils are used mainly for forest. Corn, mainly for ensilage, potatoes, radish, cabbage, buckwheat and similar crops are grown. Limited areas are used for pasture mostly consisting of wild grasses.

Distribution and Extent: These soils are of small extent and occur at relative high elevation in the less eroded granitic areas in the northeastern part of the country.

Series Proposed: Pyeongchang Gun, November 1968.

Remarks: The A horizon in the typifying pedon is thicker than normal for the series.

Chahang Series Contd.

Lab. Nos. Mh149-152 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05 .002	Clay <.002	Tex-tural Class	International CS 2-.2	FS .2-.02	Silt .02 .002	Tex-tural Class
0- 12	Ap	6.5	7.2	7.9	7.8	6.4	4.0	45.0	21.7	L	24.5	21.5	32.3	CL
12- 52	A1	7.7	6.7	8.0	6.3	4.4	2.5	46.4	25.7	L	22.0	18.9	33.4	LiC
52- 91	B1	5.2	6.1	6.6	5.6	4.4	2.4	53.8	21.1	SiL	19.3	21.2	38.4	CL
91-110	B2	8.9	5.9	5.4	5.5	4.8	3.1	52.4	22.9	SiL	17.8	17.2	42.1	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
						me/100g							
49.9	39.0	17.2	5.3	4.3	6.68	16.40	8.50	1.18	0.35	0.27	0.38	62.8	96.4
60.2	47.5	19.9	5.5	4.2	6.19	19.50	6.25	0.68	0.27	0.20	1.03	37.9	87.8
44.3	40.4	15.0	5.1	4.0	3.14	13.10	0.73	0.18	0.27	0.10	2.05	9.8	38.4
33.8	30.2	11.0	5.2	3.9	0.62	8.15	1.38	0.45	0.30	0.20	2.32	28.6	50.1

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
30 October, 1969

CHANGPYEONG SERIES

The Changpyeong series is a member of the fine clayey, mixed, nonacid, mesic family of Typic Hapludalfs (Red-Yellow Podzolic soils with high base status). These soils have thin dark brown silty clay loam Ap horizons and very thick dark red silty clay or clay Bt horizons. The C horizons are yellowish red or strong brown stratified silty clay loam to loam old alluvial materials, frequently with strongly weathered round cobbles and pebbles. They are developed on gently sloping to rolling relief on dissected old pediplains and terraces underlaid by weathered residual materials.

Typifying Pedon: Changpyeong silty clay loam, eroded - barley (Modified field description Gimje Gun profile No. 116; colors are for moist soil.)

Ap -- 0 to 18 cm. Yellowish red (5YR 4/6) silty clay loam; moderate fine granular structure; friable, very sticky and very plastic; many fine pores; many fine to medium roots; abrupt smooth boundary; pH 4.5.

Bt -- 18 to 40 cm. Dark red (2.5YR 4/5) silty clay; strong medium to coarse subangular blocky structure; many fine to coarse soft Mn concretions; firm, very sticky and very plastic; continuous thick clay cutans; common fine roots; gradual wavy boundary; pH 5.5.

B' -- 40 to 120 cm. Dark red (2.5YR 3/6) silty clay loam; weak coarse prismatic structure breaking to moderate medium subangular blocky; many fine to medium hard concretions; very firm, very sticky and very plastic; continuous thick clay cutans; common fine to medium pores; clear wavy boundary; pH 5.0.

B'21t --120 to 165 cm. Red (2.5YR 4/6) silty clay loam; weak medium to coarse prismatic structure breaking to moderate and strong medium and coarse subangular; common medium distinct yellowish red (5YR 5/6) inped mottles; few fine hard Mn concretions; very firm, very sticky and very plastic; continuous thick clay cutans; common fine to medium pores; clear wavy boundary; pH 5.0.

B'22t --165 to 200 cm. Mottled red (2.5YR 4/6), strong brown (7.5YR 5/8), light gray (10YR 7/2) and yellowish brown (10YR 5/8) silty clay; crushed color yellowish red (5YR 5/8); weak coarse prismatic structure breaking to strong coarse blocky; very firm, very sticky and very plastic; continuous thick clay cutans; few fine pores; gradual wavy boundary; pH 5.5.

B'31 -- 200 to 230 cm. Mottled yellowish brown (10YR 5/8) and light gray (10YR 7/1) clay loam; crushed color yellow (10YR 8/8); moderate coarse blocky structure; very firm, sticky and plastic; few fine mica flakes; clear smooth boundary; pH 5.5.

B'32g --230 to 280 cm. Mottled gray (10YR 7/1) and yellowish brown (10YR 5/8) wet, sandy clay loam; crushed color light gray (2.5Y N7/); weak coarse blocky structure; many fine mica flakes and round quartz pebbles; pH 5.5.

C1g -- 280 to 350 cm. Light gray (2.5Y 7/2) wet, coarse sandy loam; many white and yellow mica flakes; pH 6.0

C2g -- 350 to 400 cm. Light gray (2.5Y 7/2) wet, coarse sandy loam; many black, white and yellow coarse and fine mica flakes; pH 6.4.

Type Location: Gimje Gun, Jeollabug Do, 200 meters west of Pongweol primary school.

Range in Characteristics: Solum thickness is more than 150 cm. and bedrock is generally below 4 meters. Base saturation is more than 60 percent. Solum reaction ranges from strongly to slightly acid except where limed, and gradually increases with depth. Few to common mica. Clay content in the control section is in excess of 35 percent. The A1 or Ap horizons are dark brown, dark reddish brown, reddish brown, yellowish red or brown to dark brown silty clay loam, clay loam or silty clay. The Bt horizons are dark red, red or dark reddish brown; silty clay, heavy silty clay loam, heavy clay loam or clay, with strong blocky structure and thick clay cutans. The C horizons are mottled yellowish brown, strong brown, yellowish red, gray or light gray stratified sandy clay loam, silty clay loam, sandy loam or silt loam with variable amounts of rounded river gravel and cobbles.

Competing Series and Their Differentiae: These are the Bancheon, Gwangju, Hwadong and Gwangsan series. The Bancheon soils are less red, have less distinct structure and fewer cutans. The Gwangju soils are less red, have less distinct structure, fewer cutans and have silty mantles. The Hwadong soils have grayer colors in the B3t horizons and higher groundwater tables. The Gwangsan soils are similar except for having lower base saturation, being developed in residuum and having highly weathered very deep granitic saprolite.

Setting: The Changpyeong soils are on undulating to rolling, moderately and strongly dissected, river terrace, fan terrace and old pediplanes in broad valleys. Dominant slopes are 2 to 5 percent and the range is from 2 to 15 percent.

Principal Associated Soils: The Gwangsan, Hwadong, Banggi, Gwangju, Jeonnam, Changpyeong and Bancheon series are associated in related physiographic positions. The Jeonnam soils are less red, have less distinct structure and are derived from residual granitic materials. The Banggi soils have very gravelly to cobbly clayey textures. The Wangsan soils are at higher elevations with cooler climate and have dark A horizons.

Drainage and Permeability: Well drained. Permeability is very slow and runoff is slow to medium according to the slope.

Use and Vegetation: Most areas are used for barley, sweet potato, potato, radish, soybean, red pepper and similar crops. Some areas are used for pine forest and others for flood irrigated rice.

Distribution and Extent: The Changpyeong soils are distributed throughout the country in small areas in the major river valleys.

Series Established: Damyang Gun, Jeollanam Do, 1967.

Remarks: The typifying pedon appears to be polygenetic, which is not necessary but within the series concept.

Lab. Nos. Dm247-255 **Typifying Pedon**

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02 .002	Textural Class
0- 18	Ap	0.6	—	4.6	—	2.5	1.9	52.8	38.2	SiCL	5.2	18.1	38.5	LiC
18- 40	Bt	0.0	—	1.5	—	1.2	1.0	47.4	48.9	SiC	1.9	13.9	35.3	HC
40-120	B'	0.0	—	2.2	—	1.7	1.2	61.7	33.2	SiCL	2.6	17.4	46.8	SiC
120-165	B'21t	0.0	—	1.7	—	1.9	1.8	56.4	38.2	SiCL	2.2	13.8	45.8	SiC
165-200	B'22t	0.0	—	1.9	—	3.0	2.9	47.2	45.0	SiC	2.5	14.3	38.2	HC
200-230	B'31	0.0	—	3.4	—	10.9	7.9	42.4	35.4	CL	5.1	28.2	31.3	LiC
230-280	B'32g	0.0	—	28.8	—	24.0	7.3	13.0	26.9	SCL	34.8	27.5	10.8	SC
280-350	C1g	15.4	9.5	17.5	26.3	9.9	3.8	14.6	18.4	CoSL	55.5	19.6	6.5	SCL
350-400	C2g	0.5	9.1	16.9	20.8	14.2	7.7	21.5	9.8	CoSL	49.3	26.6	14.3	CoSL

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
35.2	29.5	13.0	4.5	4.0	0.84	35	12.05	3.25	2.62	0.22	0.57	2.04	55.3	76.6
37.0	33.3	17.7	5.2	4.5	0.80	4	15.70	3.50	5.12	0.37	0.17	0.66	58.3	93.3
34.0	31.7	12.8	5.4	4.3	0.34	-	12.30	2.62	3.25	0.27	0.12	0.86	50.9	87.9
36.8	33.8	14.3	5.4	4.2	0.27	-	15.70	4.37	3.25	0.22	0.17	1.16	51.0	87.4
40.1	36.2	18.8	5.4	4.3	0.17	-	23.50	6.75	4.12	0.25	0.17	0.98	48.0	92.0
40.0	34.8	16.9	5.2	4.3	0.17	-	12.50	6.25	3.50	0.30	0.17	0.76	81.8	93.1
31.1	24.0	12.2	5.5	4.4	0.15	-	8.90	4.62	2.50	0.27	0.15	0.40	84.7	93.8
20.4	15.9	7.5	5.8	4.7	0.15	-	6.60	3.50	1.50	0.20	0.12	0.40	80.6	93.0
34.1	25.8	6.8	5.9	4.6	0.14	-	5.10	4.37	1.37	0.25	0.10	0.15	119.4	97.6

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

CHEONGOG SERIES

The Cheongog series is a member of the fine clayey, mixed, mesic family of Typic Rhodudults (Reddish-Brown Lateritic soils). These soils have reddish brown silty clay loam A horizons and very thick dark red or dusky red silty clay or clay Bt horizons. These are residual soils developed over dark colored igneous parent materials high in ferromagnesian minerals.

Typifying Pedon: Cheongog silty clay loam - forest (Field description Ulju Gun profile No. 25; colors are for moist soil.)

A -- 0 to 9 cm. Yellowish red (5YR 4/8) dry, dark reddish brown (2.5YR 3/4) moist, clay loam; moderate very fine and fine granular structure; very friable, sticky and plastic; many fine and medium discontinuous random inped dendritic tubular pores; many fine and medium pine tree and wild grass roots; gradual smooth boundary; pH 6.0.

B11 -- 9 to 29 cm. Dark red (2.5YR 3/6) clay loam; moderate fine to medium subangular blocky structure breaking to very fine and fine granular; slightly firm, sticky and plastic; pores as above; roots as above; gradual wavy boundary; pH 5.5.

B12 -- 29 to 64 cm. Dark red (2.5YR 3/6) light clay; moderate coarse medium and fine subangular blocky structure; patchy thin clay cutans; firm, sticky and plastic; common pores as above; common roots as above; gradual wavy boundary; pH 5.5.

B21t -- 64 to 76 cm. Dark red (2.5YR 3/6) clay; strong fine and medium subangular blocky and angular blocky structure; consistence as above; pores as above; cutans as above; common very fine, fine and medium pine tree roots; clear wavy boundary; pH 5.0.

B22t -- 76 to 131 cm. Dark red (2.5YR 3/6) clay; moderate coarse medium and fine angular blocky structure; very firm, sticky and plastic; continuous thick clay cutans; few very fine discontinuous random inped simple tubular pores; few fine and medium pine tree roots; clear wavy boundary; pH 5.0.

B23t -- 131 to 180 cm. Dark red (2.5YR 3/6) clay; moderate medium fine and very fine angular blocky structure; discontinuous reddish black films and clay cutans; consistence as above; few fine discontinuous random exped simple tubular pores; few fine and medium pine tree roots; pH 5.0.

Type Location: Ulju Gun, Gyeongsangnam Do, Cheongog village, Nongso Myeon, (near the Iron mine).

Range in Characteristics: The solum thickness is normally more than 150 cm. though it ranges to 100 cm. where eroded. Soil reaction is strongly to medium acid throughout. The base saturation is generally low, though it may be medium. The A horizons are brown to dark brown, very dark brown or dark reddish gray silty clay loam, clay loam or heavy loam. The Bt horizons are dark red, dusky red or reddish brown silty clay or clay with thick continuous clay cutans in some horizons. Thickness of the Bt horizons is usually more than 100 cm. Few or no mica flakes are present. The C horizons are yellowish red, red or reddish brown clay loam or silty clay strongly weathered saprolite usually with clay flows on structural faces of weathered blocky gabbro, diorite or diabase parent materials. A few angular blocky cobbles and bedrock outcrops normally are present.

Competing Series and Their Differentiae: The Pyeongchang, Bonggye, Changpyeong, Dalcheon, Gwangsan, Jeonnam, Jingog and Bansan soils are competing series. The Pyeongchang soils are higher in reaction, have high base saturation and are developed over limestone rather than basic crystalline rocks. The Bonggye soils have less red subsoil colors, pale surface colors and have somewhat coarser textures. The Changpyeong soils have similar sola but have C horizons in stratified, acidic and mixed old alluvial materials. The Dalcheon soils have moderately deep Bt horizons formed in granitic residuum. The Gwangsan and Jeonnam soils have deep Bt horizons formed in granitic residuum. The Jingog soils have light colored silty mantles. The Bansan soils have darker colored A horizons and contain mica.

Setting: The Cheongog soils occur on moderately steep to steep mountains and hills and are derived from dark colored basic crystalline rocks. Slopes range mostly from 10 to 50 percent with 15 to 30 percent slopes dominating.

Principal Associated Soils: The Jeongja, Bonggye and Mudeung soils occur on similar slopes. The Jeongja soils have fine loamy textures and are shallow over hard bedrock high in ferromagnesian minerals. The Mudeung soils have fine loamy textures and are shallow over hard andesite porphyry bedrocks.

Drainage and Permeability: Well drained. Permeability is slow. Runoff is rapid or very rapid.

Use and Vegetation: Most of these soils are used for forest but small areas are cultivated for soybean, red pepper, corn and similar crops.

Distribution and Extent: The Cheongog soils are of small extent and occur throughout the country in areas of dark colored igneous rocks generally high in ferromagnesian minerals.

Series Established: Ulju Gun, Gyeongsangnam Do, July 1969.

Remarks: The silty clay loam surface texture in the typifying pedon is probably due to erosion of the A horizon and subsequent mixing with the B horizon. See the Jeonnam series remarks for base saturation.

Lab. Nos. U166-171 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	Intl. CS 2-.2	Intl. FS .2-.02	Intl. Silt .02-.002	Intl. Textural Class
			Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture								International			
0- 9	A	0.6	0.6	1.7	2.7	4.7	3.1	58.8	28.4	SiCL	6.0	18.3	47.3	SiC
9- 29	B11	0.3	0.5	1.7	2.5	3.8	2.5	56.3	32.7	SiCL	5.5	16.0	46.3	SiC
29- 64	B12	0.1	0.3	1.3	2.0	2.7	1.7	54.5	37.5	SiCL	4.1	12.8	45.6	SiC
64- 76	B21t	0.2	0.4	1.2	1.6	2.3	1.4	44.9	47.7	SiC	3.7	9.7	38.9	HC
76-131	B22t	4.5	0.4	1.4	2.1	2.7	1.7	38.8	53.3	C	4.5	7.8	34.4	HC
131-180	B23t	4.1	0.4	1.3	2.0	3.4	2.4	35.0	55.5	C	4.4	13.1	27.0	HC

Moisture Retention % 1/10 atms	1/3 atms	15 atms	S.G.	Atterberg Limits % LL	PI	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Ca	Mg	Na	K	H
											Extractable Cations me/100g				
	31.2	13.3	2.84	39.7	15.0	5.4	3.9	0.90	4	6.40	0.95	0.35	0.08	0.14	-
	27.4	19.1	2.82	40.3	17.4	5.3	3.8	1.30	2	6.70	0.05	0.35	0.08	0.11	-
	29.1	14.9	2.87	44.4	21.9	5.3	3.8	0.80	-	5.40	0.05	0.45	0.14	0.14	-
	31.1	17.1	2.81	53.5	28.8	5.4	3.7	0.70	-	8.00	0.10	0.75	0.15	0.14	-
	32.8	20.4	2.86	55.0	26.4	5.4	3.6	0.30	-	8.90	0.50	1.00	0.19	0.19	-
	34.2	21.6	2.90	55.4	24.5	5.3	3.7	0.20	-	9.90	1.40	2.45	0.25	0.28	-

Base Saturation % CEC	Sum of Cations
23.8	-
8.8	-
13.4	-
14.3	-
21.1	-
44.2	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate

Established Series
UKT, KTJ, JFD
4 November, 1969

CHEONGSIM SERIES

The Cheongsim series is a member of the fine loamy, mixed, mesic family of Typic Dystrochrepts (Acid Brown Forest soils). These soils have thin very dark brown gravelly silt loam A horizons and moderately deep yellowish brown or brown gravelly loam cambic B horizons. C horizons are moderately thick yellowish brown very gravelly loam over hard consolidated shale and siltstone. These soils are developed on steep mountain slopes in slight concave positions.

Typifying Pedon: Cheongsim very gravelly silt loam - forest (Field description Pyeongchang Gun profile No. 138 is typical except for having more than 35 percent coarse fragments; colors are for moist soil.)

A11 --- 0 to 13 cm. Very dark brown (10YR 2/2) very gravelly silt loam; moderate fine and medium granular structure; very friable, slightly sticky and slightly plastic; about 60 percent slightly weathered grayish brown shale gravel and cobbles; many medium roots; gradual smooth boundary; pH 6.0.

A12 --- 13 to 19 cm. Dark brown (10YR 3/3) very gravelly loam; moderate fine, medium and coarse granular structure; friable, slightly sticky and slightly plastic; clear wavy boundary; otherwise as above.

B --- 19 to 62 cm. Dark yellowish brown (10YR 4/4) very gravelly to cobbly loam; weak coarse subangular blocky structure, breaking to moderate fine and medium granular; friable, slightly sticky and slightly plastic; gravel and cobble as above; common fine and medium roots; abrupt wavy boundary; pH 6.0.

C --- 62 to 70 cm. Slightly weathered grayish brown shale bedrock.

R --- 70 cm. Hard gray shale.

Type Location: Pyeongchang Gun, Gangweon Do, about 300 m. west of Geomun Ri, Jinbu Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm., and depth to hard rock is about 100 cm. Base saturation is more than 60 percent in the A horizons and is less than 60 percent in the cambic B horizon. Reaction is strongly to medium acid, depending on geologic stratification. These soils contain between 10 and 35 percent slightly weathered shale, sandstone and siltstone gravel, cobble and some stone throughout the solum. A horizons are 10 to 20 cm. thick, very dark brown, dark brown or brown silt loam, loam or light silty clay loam. Organic matter content of the A horizons commonly ranges from 3 to 10 percent. Cambic B horizons are dark yellowish brown, yellowish brown, strong brown or brown gravelly, cobbly or stony loam, silt loam or silty clay loam. The bedrock is commonly slightly to unweathered consolidated shale and fine textured sandstone materials.

Competing Series and Their Differentiae: Related soils are the Daegu, Sirye, Panho, Mudeung and Jangseong series. The Daegu soils lack dark organic A horizons, have loamy skeletal textures and hard bedrock within 50 cm. of the surface. The Sirye soils have fine clayey textures, yellowish red colors and argillic B horizons. The Panho soils have high base saturation and are formed in alluvial-colluvial materials on local fans. The Mudeung soils have shallow sola, less organic A horizons and are formed in andesite porphyry materials. The Jangseong soils lack dark A horizons and are less than 50 cm. thick over hard limestone bedrocks.

Setting: The Cheongsim soils are on steep mountain sides in smooth and slight concave positions and concave mountain top areas in materials derived from grayish brown residual shales. Slopes ranges from 15 to 100 percent and dominant slopes are 30 to 60 percent.

Principal Associated Soils: These are the Sinbul, Odae and Weoljeong soils in associated granitic areas. The Sinbul soils have thicker dark colored A horizons and thicker C horizons formed in mountain colluvium. The Odae soils have coarse loamy textures and are shallow over hard residual granitic rocks. The Weoljeong soils have coarse loamy textures and very deep saprolite.

Drainage and Permeability: Somewhat excessively drained. Permeability is moderate and runoff is rapid to very rapid according to the slope.

Use and Vegetation: Most areas are used for forest though some small areas are used for radish, corn, potato and similar crops.

Distribution and Extent: The Cheongsim soils are of moderate extent in high mountain sedimentary areas of the country.

Series Established: Pyeongchang Gun, Gangweon Do, 1968.

Remarks: The Typifying Pedon contains more gravel than the 10 to 35 percent which is characteristic of the series.

Cheongsim Series Contd.

Lab. Nos. Mh324-325 Typifying Pedon

Depth cm	Hori-zon	Gra-vel 2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 13	A11	74.1	6.7	3.4	3.5	0.9	14.8	50.1	20.6	SiL	14.3	35.1	30.0	CL
13- 19	A12	76.9	8.0	6.0	5.4	9.2	7.6	43.3	20.1	L	20.3	31.5	28.1	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations (me/100g) Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
	48.2	30.1	5.6	4.5	10.22	23.20	18.50	2.65	0.08	0.48	-	93.6	-
	36.2	15.6	5.0	3.4	4.22	13.20	3.20	0.60	0.05	0.15	-	30.3	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UFT, JFD
31 October, 1969

CHUNDO SERIES

The Chundo series is a member of the fine clayey, mixed, mesic family of Ultic Hapludalfs (Gray-Brown Podzolic soils). These soils have thin or moderately thick dark brown loam A horizons and very thick dark brown to dark yellowish brown silty clay Bt horizons. The C horizons are very dark brown loam to fine sandy loam. They are developed on intermediate moderately dissected terraces derived from fluvio-marine materials.

Typifying Pedon: Chundo loam - soybean (Field description Ulju Gun profile No. 94; colors are for moist soil.)

Ap -- 0 to 18 cm. Dark brown (10YR 3/4) loam; yellowish brown (10YR 5/4), dry; moderate fine to coarse granular structure; friable, sticky and plastic; many very fine and fine continuous random exped and inped dendritic interstitial pores; few fine dead soybean roots; abrupt smooth boundary; pH 8.5.

B1t -- 18 to 46 cm. Very dark grayish brown (10YR 3/2) clay loam; dark grayish brown (10YR 2/2), dry; weak medium and coarse subangular blocky structure, breaking partly to moderate medium granular; firm, sticky and plastic; many fine and medium discontinuous random inped and exped dendritic tubular pores; many medium and coarse earthworm holes; few fine dead soybean roots; clear wavy boundary; pH 7.5.

B21t -- 46 to 60 cm. Dark brown (10YR 3/3) clay; moderate medium and coarse subangular blocky structure; firm, very sticky and very plastic; patchy thin clay cutans; many fine and medium discontinuous random exped and inped dendritic tubular pores and many medium and coarse random earth worm holes; few medium black earthworm excrements; few fine dead soybean roots; gradual wavy boundary; pH 7.0.

B22t -- 60 to 80 cm. Dark yellowish brown (10YR 3/4) clay; moderate medium and coarse subangular blocky structure; firm, very sticky and very plastic; patchy thin clay cutans; many fine and very fine continuous random inped simple tubular pores; occasional coarse earthworm holes; no roots; gradual wavy boundary; pH 6.5.

B3t -- 80 to 106 cm. Yellowish brown (10YR 5/4) clay; weak medium and coarse subangular blocky structure; firm, very sticky and very plastic; patchy thin clay cutans; common very fine and fine discontinuous random inped simple tubular pores; clear smooth boundary; pH 6.0.

C1 -- 106 to 150 cm. Mottled grayish brown (10YR 5/2) and brownish yellow (10YR 6/8) silty clay loam; many very coarse distinct strong brown (7.5YR 5/8) mottles; weak very coarse subangular blocky structure; crushed color light yellowish brown to brownish yellow (10YR 6/5); firm, sticky and plastic; few fine and medium discontinuous random inped simple tubular pores; abrupt smooth boundary; pH 6.0.

C2 -- 150 to 175 cm. Very dark brown (10YR 7/4) loamy sand; many very coarse distinct brownish yellow (10YR 6/8) mottles; structureless (massive); crushed color yellow (10YR 7/8); firm, nonsticky and nonplastic; pH 5.5.

Type Location: Ulju Gun, Gyeongsangnam Do, about 100 meters west of Dalpo Bay Beach, Onsan Myeon.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. and depth to hard rock is probably greater than 4 meters. Base saturation is more than 35 percent at a depth of 125 cm. below the top of the argillic horizon. Reaction is slightly acid to neutral in the control section which may be correlated with the presence of wind blown sea water salt. These soils contain between 35 and 60 percent clay in the Bt horizons. The Ap horizons are dark brown, dark grayish brown, very dark grayish brown or brown loam, silt loam, silty clay loam or clay loam ranging in thickness from 15 to 25 cm. The Bt horizons are deep, dark brown, dark yellowish brown, yellowish brown or strong brown silty clay, clay, heavy silty clay loam or clay loam. The C horizons are grayish brown, brownish yellow, yellow or dark brown loam stratified fine sandy loam or loamy fine sand, probably sea beach alluvial deposits.

Competing Series and Their Differentiae: The competing soils are in the Hwadong, Geugrag and Bancheon series. The Hwadong soils have gray drainage mottles in the lower Bt horizons and are derived from continental alluvium. The Geugrag soils are similar to the Hwadong soils except for having gray drainage mottles throughout the Bt horizon. The Bancheon soils have red colors and are on higher river terraces.

Setting: The Chundo soils are on very gently sloping intermediate moderately dissected terraces derived from fluvio-marine or similar materials. Dominant slopes are 1 to 3 percent and the range is from 0 to 15 percent.

Principal Associated Soils: Hwadong, Bancheon and Jisan soils are associated with Chundo series. Small sand dunes commonly occur near the sea coast. The Jisan soils have gray colors in the B horizons and occur in fine loamy local valley alluvium. The Hwadong and Bancheon soils are associated in somewhat similar physiographic positions.

Drainage and Permeability: Well drained. Runoff is slow to medium and permeability is slow.

Use and Vegetation: Most of these soils are used for soybean, barley, wheat, red pepper, sesame, onion, tobacco and similar crops.

Distribution and Extent: The Chundo series is of small extent and is known to occur along the southeast coast.

Series Established: Ulju Gun, Gyeongsangnam Do, 1968

Remarks: The Chundo series is on terrace remnants near the sea in positions which receive wind brown sea water. The salt does not appear to accumulate in the profile in amounts sufficient to be detrimental to crops commonly grown in the area.

Lab. Nos. U500-506 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori- zon	Gra- vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay ≤.002	Tex- tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 18	Ap	2.0	—1.5—		8.9	18.0	6.4	41.1	24.1	L	15.9	30.4	29.6	CL
18- 46	B1t	0.0	—	4.2	—	10.5	3.2	46.7	35.4	SiCL	7.0	20.7	36.9	LiC
46- 60	B21t	0.0	—	1.8	—	5.1	1.6	51.5	40.0	SiC	3.0	12.3	44.7	LiC
60- 80	B22t	0.0	—	1.7	—	5.2	1.5	51.0	40.6	SiC	2.9	11.5	45.0	LiC
80-106	B3t	0.0	—	2.2	—	7.8	1.4	48.6	40.0	SiC	3.9	16.0	40.1	LiC
106-150	C1	0.0	0.0	0.3	6.6	22.0	7.9	39.9	25.3	L	13.1	30.1	33.5	LiC
150-175	C2	0.0	—1.0—		15.2	39.6	8.0	26.8	9.4	FSL	29.7	43.3	17.6	FSL

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
	25.5	12.8	7.7	6.7	3.10	18.80	24.2	2.10	0.40	0.28	-	143.5	-
	32.6	18.0	7.3	6.1	4.46	23.20	22.0	1.60	0.72	0.16		105.0	-
	34.8	19.7	6.4	4.8	2.89	12.90	6.8	1.90	0.78	0.12	-	75.0	-
	33.4	18.9	6.0	4.6	2.49	13.62	6.4	1.40	0.72	0.10		63.0	-
	30.0	15.0	5.6	4.1	1.79	11.20	4.3	1.50	0.66	0.14	-	95.0	-
	26.2	9.5	5.0	3.8	0.56	6.56	1.8	0.70	0.28	0.08	-	44.0	-
	17.2	4.8	5.1	3.9	0.42	4.52	1.0	1.00	0.26	0.04	-	51.0	-

Elemental Analysis of Clay							3/
H_2O %	Igni loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	CEC me/100g
5.84	10.34	2.06	46.49	9.77	32.12	0.92	47.0
4.02	10.88	2.04	45.78	9.47	32.11	1.94	-
-	-	-	-	-	-	-	-
3.83	10.55	2.12	45.88	9.63	30.51	2.18	29.0
-	-	-	-	-	-	-	-
2.72	11.24	2.22	47.52	7.37	31.56	1.81	36.0
-	-	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$, Saturated, NaCl Extracted

Established Series
UKT, JFD
4 November, 1969

DAEGU SERIES

The Daegu series is a member of the loamy skeletal, mixed,nonacid, mesic family of Lithic Eutrochrepts (Lithosols). These soils have very thin brown to dark brown shaly loam A horizons and moderately thick yellowish brown very shaly silty clay loam cambic B horizons. C horizons are thin or very thin very shaly silty clay loam over hard grayish brown shale bedrock. They occur in rolling hilly upland areas.

Typifying Pedon: Daegu shaly loam - wild grass (Field description Dalseong Gun profile No. 111; colors are for moist soil.)

A -- 0 to 7 cm. Brown to dark brown (10YR 4/4) shaly loam; moderate fine and medium granular structure; friable, slightly sticky and slightly plastic; about 15 percent slightly weathered grayish brown shale fragments; many fine grass roots; clear smooth boundary; pH 6.5.

B -- 7 to 20 cm. Yellowish brown (10YR 5/6) very shaly sandy clay loam; moderate medium and fine subangular blocky structure; firm, sticky and plastic; about 50 percent fragments as above; clear smooth boundary; pH 6.8.

C -- 20 to 25 cm. Brown to dark brown (10YR 3/4) very shaly loam; residual rock structure; about 80 percent shale fragments; pH 6.8.

R -- 25 to 50 cm. Unweathered olive brown hard shale bedrock.

Type Location: Daegu City, Gyeongsangbug Do, about 500 meters west of Ayang Bridge, Omog Dong.

Range in Characteristics: Solum thickness ranges from 20 to 50 cm. and hard rock is within 50 cm. of the surface. Base saturation is more than 60 percent. Reaction is medium to slightly acid. B and C horizons contain 35 to 90 percent medium and fine shale fragments. The A horizons are less than 10 cm. thick, brown to dark brown, pale brown or light yellowish brown shaly loamy or silt loam. Bedrock outcrops may be from none to 90 percent. Cambic B horizons are 10 to 30 cm. thick, yellowish brown, dark yellowish brown, brownish yellow, light yellowish brown or brown very shaly clay loam, sandy clay loam, loam or silty clay loam. C horizons are very thin, olive brown, olive yellow, light yellowish brown, dark yellowish brown or brown very shaly silt loam, silty clay loam, loam or clay loam more or less abruptly over hard grayish brown shale and sandstone bedrocks.

Competing Series and Their Differentiae: These are the Cheongsim, Habin, Sirye, Buyeo, Jeongja, Jangseong and Mudeung series. The Cheongsim soils are moderately deep over hard bedrock. The Habin soils have coarse loamy textures and are derived from reddish brown shale materials. The Sirye soils have moderately deep yellowish red argillic B horizons. The Buyeo soils have moderately deep reddish brown argillic B horizons and are derived from reddish brown shale materials. The Jeongja soils contain less fragments and are derived from dark colored fine textured basic igneous materials. The Mudeung soils contain less gravel and are derived from andesite porphyry materials.

Setting: Daegu soils occur in rolling, hilly and mountainous areas and are derived from residual interbedded grayish brown shale, sandstone and some metamorphic materials. Dominant slopes are 7 to 30 percent and the range is from 2 to 60 percent.

Principal Associated Soils: The Cheongsim, Sirye, Banho and Yuga soils are closely associated with the Daegu soils. The Cheongsim soils occur in similar physiographic positions. The Sirye soils usually occur in lower physiographic positions on more gentle slopes. The Banho soils are gravelly and are associated in local alluvial-colluvial positions. The imperfectly drained Yuga soils are associated in local alluvial positions.

Drainage and Permeability: Somewhat excessively drained. Permeability is probably moderate and runoff is rapid to very rapid depending on the slope gradient. Due to shallow depth, the soil is droughty.

Use and Vegetations: Most areas grow pine trees and wild grasses. Some areas with smoother slopes are used for barley, sesame, corn, bean, soybean, red pepper, red bean, green bean and similar upland crops.

Distribution and Extent: The Daegu soils are of moderate extent and are distributed in the southern and east central parts of the country.

Series Established: Dalseong Gun, Gyeongsangbug Do, 1966.

Lab. Nos. T326-328 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 7	A	12.5	11.7	13.3	8.3	1.8	5.4	34.4	25.1	L	33.9	16.2	24.8	LiC
7- 20	B	52.9	16.7	19.7	11.5	4.4	2.9	23.3	21.5	SCL	48.9	13.1	16.5	SCL
20- 25	C	84.0	10.9	9.8	5.9	3.5	2.7	35.1	32.1	CL	27.1	17.3	23.5	LiC

pH H_2O (1:1)	pH 1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
			me/100g							
6.7	5.7	5.07	18.50	9.25	3.25	0.10	0.45	-	70.5	-
6.1	4.8	1.11	15.60	7.12	3.50	0.10	0.27	-	70.5	-
6.1	-	-	16.00	6.62	3.75	0.15	0.22	-	67.1	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
16 October, 1969

DALCHEON SERIES

The Dalcheon series is a member of the fine clayey, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have thin brown loam A horizons and moderately deep yellowish red clay loam or clay Bt horizons. C horizons are brown friable silt loam in strongly and deeply weathered residual granitic materials.

Typifying Pedon: Dalcheon loam, eroded - tobacco (Field description Buyeo Gun No. 214; colors are for moist soil.)

Ap -- 0 to 7 cm. Strong brown (7.5YR 5/6) slightly gravelly loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; few fine mica; abrupt smooth boundary.

B21t -- 7 to 15 cm. Yellowish red (5YR 5/8) slightly gravelly loam or clay loam; moderate medium and coarse subangular blocky structure; friable, sticky and plastic; few fine mica; clear wavy boundary.

B22t -- 15 to 30 cm. Yellowish red (5YR 4/6) silty clay; strong fine and medium subangular blocky structure; firm, very sticky and very plastic; thick continuous clay cutans; few fine mica; clear wavy boundary.

B3t -- 30 to 55 cm. Mottled reddish yellow (5YR 6/8) and red (2.5YR 4/6) silty clay; crushed color red (2.5YR 4/6); moderate medium and coarse subangular blocky structure; firm, sticky and plastic; thick continuous clay cutans; few fine mica; clear wavy boundary.

C -- 55 to 125 cm. Mottled brownish yellow (10YR 6/8) and yellowish red (5YR 4/4) silt loam; crushed color yellowish red (5YR 5/8); structureless (massive); slightly firm, slightly sticky and slightly plastic; common fine mica; very deep and extremely weathered residual granite saprolite.

Type Location: About 1 km. west of Jeongag Ri crossroads, Seogseong Myeon, Buyeo Gun, Chungcheongnam Do.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. Common bed rock outcrops and few gravel may occur. Reaction is strong to medium acid. Al or Ap horizons are brown to dark brown, strong brown or yellowish red loam, silt loam, clay loam or silty clay loam ranging in thickness from 5 to 15 cm. The redder finer textured A horizons commonly occur in eroded areas. B horizons are moderately deep, yellowish red, red or strong brown clay, clay loam, silty clay or silty clay loam ranging in thickness from 50 to 90 cm. and averaging about 60 cm. C horizons are mixed yellowish red, brown, red, strong brown and yellow loam, silt loam, silty clay loam, sandy loam and sandy clay loam deeply weathered granitic saprolite. Clay cutans may occur in the upper C horizon in cracks and rock structure faces. Bedrock outcrops may or may not occur.

Competing Series and Their Differentiae: These are the Bonggye, Cheongog, Jeonnam, Songjeong, Sirye, Jingog, Gwangsan and Bansan series. The Bonggye soils are mica free and deep over andesite porphyry saprolite. The Cheongog soils have dark red sola, thinner saprolite and are derived from dark colored mica free residuum high in ferromagnesian minerals. The Jeonnam soils have deep sola. The Songjeong soils have fine loamy textures, and deep sola with less distinct Bt horizon structure. The Sirye soils are developed on grayish brown shale and fine grained sandstone materials and have high base saturation. The Jingog soils have yellowish brown silty mantles over deep residual Bt horizons. The Gwangsan soils have deep sola and more distinct Bt horizon structure. The Bansan soils have dark colored A horizons and deep residual Bt horizons.

Setting: The Dalcheon soils occur on rolling to steep hilly and low mountainous areas underlain by deeply and strongly weathered granitic saprolite. Slopes range from 7 to 60 percent and are dominantly 15 to 30 percent.

Principal Associated Soils: These are the Samgag, Gwanag, Jeonnam and Songjeong soils. The Samgag soils have coarse loamy textures and less red colors. The Gwanag soils are shallow and have hard-rock within 50 cm. of the surface.

Drainage and Permeability: The Dalcheon soils are well drained and slowly permeable. Runoff is rapid or very rapid depending on slope gradient.

Use and Vegetation: Most of the less sloping areas are used for cultivated upland crops such as tobacco, potato, soybean, red pepper, and leafy vegetables. Most of the more sloping areas grow pine forest.

Distribution and Extent: The Dalcheon soils are of moderate extent and are distributed in hilly and mountainous areas underlain by granitic geology throughout the country especially in the south.

Series Established: Ulju Gun, Gyeongsangnam Do, March 1967.

Remarks: The Dalcheon series appears to include both natural moderately deep soils and eroded deep soils with moderate depth remaining. The range of base saturation in this and similar residual granitic soils is mostly between 15 and 35 percent, however some profiles have base saturation between 35 and 60 percent. There appears at the present time to be no way to separate these soils in the field at the 35 percent level. These series are therefore placed in the Typic subgroup and the 35 to 60 percent portion is considered as a taxonomic inclusion.

Remarks: The range of base saturation in this and similar residual granitic soils is mostly between 15 and 35 percent; however many profiles have base saturation between 35 and 60 percent. There appears to be no way to separate these soils at the 35 percent level at the present time. These series are therefore placed in the Typic subgroup and the 35 to 60 percent portion is considered as a taxonomic inclusion.

Lab. Nos. Cg279-283 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 7	Ap	8.8	3.9	6.5	6.5	6.9	6.7	46.4	23.1	L	17.9	28.1	30.9	CL
7- 15	B21t	11.1	1.7	1.8	2.8	6.0	8.5	37.9	41.3	C	6.9	26.4	25.4	LiC
15- 30	B22t	4.3	1.9	0.9	1.5	4.4	7.7	30.9	52.7	C	4.7	20.4	22.2	HC
30- 55	B3t	3.9	0.7	1.7	2.7	6.5	8.5	35.8	44.1	C	5.7	24.0	26.2	LiC
55-125	C	3.3	—	5.9	—	17.8	16.3	39.4	20.6	L	8.3	42.8	28.3	CL

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg me/100g	Na	K	H	CEC	Sum of Cations
-	30.2	14.0	5.2	4.2	1.24	9.70	3.40	1.65	0.10	0.68	-	60.1	-
41.5	36.4	20.1	5.5	3.9	0.70	13.60	1.30	1.70	0.10	0.30	-	25.0	-
44.7	40.6	23.8	5.6	3.8	0.43	14.10	0.85	1.30	0.13	0.13	-	17.1	-
42.6	38.8	22.0	5.5	3.8	0.28	14.30	0.85	1.70	0.20	0.13	-	20.1	-
53.8	36.4	18.0	5.5	3.7	0.17	13.50	0.90	1.95	0.13	0.15	-	23.2	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UFT, JFD
4 November, 1969

DALDONG SERIES

The Daldong series is a member of the fine silty over sandy, mixed, nonacid, mesic family of Aeric Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick grayish brown silt loam Apg horizons and moderately deep distinctly or prominently mottled dark grayish brown and brown silt loam cambic Bg horizons. The Cg horizons are grayish brown stratified loamy sand and sand with mottles. These soils are developed on level fluvio-marine plains in alluvial materials.

Typifying Pedon: Daldong silt loam - paddy rice (Field description Ulju Gun profile No. 63; colors are for moist soil.)

Ap1 -- 0 to 14 cm. Dark yellowish brown (10YR 4/4) silt loam; common fine and medium faint dark grayish brown (10YR 4/2) and distinct strong brown (7.5YR 5/8) mottles; crushed color dark brown to dark yellowish brown (10YR 3/3.5); puddled structure, breaking to weak fine and medium granular; friable, slightly sticky and slightly plastic; many very fine mica; many very fine and medium dead rice and wild grass roots; abrupt wavy boundary; pH 5.0. The farmer has probably added red upland soil to this horizon.

Ap2g -- 14 to 22 cm. Very dark gray (10YR 3/1) silty clay loam; common fine to coarse distinct yellowish red (5YR 5/8) mottles; crushed color dark grayish brown (10YR 4/2); weak fine to coarse platy and subangular blocky structure; firm, slightly sticky and slightly plastic; few very fine and fine continuous random inped simple tubular pores; mica as above; common fine and medium dead rice roots; clear smooth boundary; pH 6.0.

B2g -- 22 to 50 cm. Dark grayish brown (10YR 4/2) silty clay loam; common fine and medium distinct strong brown (7.5YR 5/6) inprism mottles; crushed color dark yellowish brown (10YR 4/4); weak coarse prismatic structure breaking to moderate fine to coarse subangular blocky; firm, slightly sticky and slightly plastic; patchy thin gray clayey exprism cutans; mica as above; clear smooth boundary; pH 7.0.

B3g -- 50 to 62 cm. Dark grayish brown (10YR 4/2) silt loam; common fine and coarse distinct strong brown (7.5YR 5/6) inprism mottles; crushed color dark brown to brown (10YR 4/3); weak coarse prismatic structure breaking to moderate fine to coarse subangular blocky; firm, slightly sticky and slightly plastic; mica as above; patchy thin gray clayey cutans on prisms; clear smooth boundary; pH 7.0.

Cg -- 62 to 120 cm. Grayish brown (10YR 5/2) loamy fine sand; common medium and coarse prominent yellowish red (5YR 4/6) and few coarse black (10YR 2/1) mottles; crushed color yellowish brown (10YR 5/6); structureless (massive); weakly stratified; mica as above; pH 8.3.

Type Location: Ulsan City, Gyeongsangnam Do, about 700 meters south of Kyeongcheong Dong, Ulsan City.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is probably more than 5 meters. Base saturation is more than 60 percent. Reaction is medium acid in the surface and slightly acid to neutral in the Bg and Cg horizons. Common to many mica occur throughout the profile. Few gravel and sea shells may occur in the lower substrata. Apg horizons range from 20 to 30 cm. thick, are dark yellowish brown, grayish brown, gray and dark grayish brown silt loam to light silty clay loam with distinct or prominent mottles. Cambic Bg horizons are very dark grayish brown, dark grayish brown, gray, dark gray, olive gray or grayish brown silt loam or light silty clay loam with common or many distinct or prominent yellowish red, strong brown, reddish brown or dark yellowish brown mottles. Clay content ranges between 18 and 35 percent and sand less than 15 percent. Cg horizons are usually gray, dark gray or grayish brown stratified sand or fine sand with few or common distinct or prominent yellowish red or strong brown mottles.

Competing Series and Their Differentiae: These include the Deogha, Deunggu, Gimhae, Hagseong, Sadu, Mangyeong and Jeonbug soils. The Deogha soils have deep fine silty textures and have sea shells in the Cg horizons. The Deunggu soils have moderately deep fine silty textures and contain iron sulfates. The Gimhae soils have deep fine silty textures, grayer colors, poor drainage, and contain iron sulfates. The Hagseong soils are grayer, contain fewer mottles in the Bg horizon, and occupy slightly lower positions with higher watertables. The Sadu soils have sandy textures, browner colors and better drainage. The Mangyeong soils have coarse silty textures throughout. The Jeonbug soils have fine silty textures throughout.

Setting: The Daldong soils occur on nearly level fluvio-marine plains and are derived from fluvio-marine deposits. Slopes are about 1 percent.

Principal Associated Soils: The Hagseong, Deogha, Hwabong and Sindab soils are associated. The well drained Hwabong and poorly drained Sindab soils are associated in nearby sandy continental alluvium adjacent to fresh water river channels. The Hagseong and Deogha soils are associated in slightly lower positions on fluvio-marine plains.

Drainage and Permeability: Imperfectly drained. Permeability is moderately slow and runoff is slow or very slow. Depth to the fluctuating watertable varies between 25 and 50 cm. except where artificially controlled.

Use and Vegetation: Most areas are used for rice but some artificially drained areas are used also for barley or wheat.

Distribution and Extent: : These soils are of small extent and occur in the south and western parts of the country where continental alluvium joins the fluvio-marine plains.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966

Lab. Nos. U353-357 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 14	Ap1	0.0	———	1.1	———	2.9	9.3	67.6	19.1	SiL	1.4	38.4	41.1	CL
14- 22	Ap2g	0.0	———	1.1	———	2.8	9.0	66.0	21.1	SiL	1.5	35.3	42.1	CL
22- 50	B2g	0.0	———	0.6	———	1.3	4.9	70.6	22.6	SiL	1.0	28.1	48.3	SiCL
50- 62	B3g	0.0	———	0.8	———	11.7	16.3	53.0	18.2	SiL	1.4	49.3	31.1	CL
62-120	Cg	12.5	———	5.3	———	40.7	30.0	19.7	4.3	LS	9.7	75.5	10.5	LFS

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	S.G.	EC mmhos/cm at 25°C	Moist. at Sat. %	pH: H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	Free Fe_2O_3 %
	44.1	15.4	2.64	0.72	49.4	4.9	3.7	2.10	32	1.19
	43.4	15.4	2.64	0.78	49.3	5.5	4.3	2.00	30	1.29
	38.8	15.4	2.67	0.54	40.3	6.4	5.2	1.30	12	1.48
	34.3	15.8	2.69	0.60	46.3	6.8	5.1	0.90	15	1.42
	14.1	5.1	2.69	0.60	30.8	7.5	5.4	0.70	9	0.75

2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations	Elemental Analysis of Clay: SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	3/ CEC me/100g
14.40	7.25	3.00	0.39	0.20	-	74.9	-	2.36	53.07	9.74	31.93	50.05
15.00	8.20	4.30	0.38	0.20	-	86.9	-	-	-	-	-	-
15.40	9.35	4.60	0.35	0.10	-	93.5	-	2.22	53.29	8.96	35.04	33.53
13.20	9.26	3.80	0.33	0.20	-	102.3	-	2.34	54.19	9.84	33.06	-
5.90	4.15	1.65	0.15	0.10	-	102.5	-	2.23	51.48	12.60	31.08	40.04

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, 1 N NaCl Extracted

Established Series
UKT, FPJ, JFD
4 November, 1969

DEOGHA SERIES

The Deogha series is a member of the fine silty, mixed, nonacid, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick dark grayish brown silt loam Apg horizons and moderately deep grayish brown silty clay loam cambic Bg horizons over very deep very dark gray clay loam C horizons with sea shells. They are developed on level to nearly level fluvio-marine plains.

Typifying Pedon: Deogha silt loam - paddy rice (Field description Ulju Gun profile No. 103; colors are for moist soil.)

Ap1g -- 0 to 13 cm. Dark gray (10YR 4/1) silt loam; many fine to coarse prominent strong brown (7.5YR 5/6) mottles; crushed color dark grayish brown (10YR 4/2); puddled, to weak coarse blocky structure; friable, slightly sticky and slightly plastic; many very fine and medium dead rice roots; abrupt smooth boundary; pH 5.0.

Ap2g -- 13 to 23 cm. Grayish brown (10YR 5/2) silt loam; many fine to coarse prominent strong brown (7.5YR 5/6) mottles; firm, sticky and plastic; weak fine and medium platy and subangular blocky structure; continuous vertical and oblique inped and exped open tubular pores; common fine and medium roots as above; clear smooth boundary; pH 6.5.

B1g -- 23 to 50 cm. Dark gray (10YR 4/1) silty clay loam; common medium and coarse distinct brown to dark brown (7.5YR 4/4) mottles; crushed color brown to dark brown (10YR 4/3); weak medium and coarse prismatic structure; thin continuous grayish brown clayey cutans; firm, sticky and plastic; common pores as above; very few fine roots as above; clear smooth boundary; pH 6.5.

B2g -- 50 to 80 cm. Grayish brown (10YR 5/2) silty clay loam; common fine and medium faint yellowish brown (10YR 5/4) inprism mottles; patchy thin exped clayey cutans; crushed color brown to dark brown (10YR 4/3); moderate medium and coarse prismatic structure weakening with depth; firm, sticky and plastic; common pores as above; clear smooth boundary; pH 6.5.

Cg -- 80 to 130 cm. Dark gray to very dark gray (5Y 3.5/1) clay loam; structureless (massive) stratified; firm, sticky and plastic; about 15 percent weathered sea shells; few or no mica; pH 8.0.

Type Location: Ulju Gun, Gyeongsangnam Do, about 200 meters north of Songjeong Ri, Cheongryang Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. Depth to hard rock is probably more than 5 meters. Base saturation is more than 60 percent. Reaction is strongly acid in surface and slightly acid in the cambic Bg horizons generally increasing to neutral in the Cg horizons. Apg horizons are dark gray, dark grayish brown, grayish brown or very dark grayish brown distinctly or prominently mottled, silt loam, silty clay loam, loam or clay loam. The cambic Bg horizons are grayish brown, dark gray or dark grayish brown silt loam, silty clay loam or loam with weak prismatic structure and few or common strong brown, yellowish brown, dark yellowish brown, yellowish red or brown to dark brown mottles. Cg horizons are stratified mainly very dark gray or dark gray clay loam, silty clay loam, silt loam or loam with 10 to 30 percent slightly to strongly weathered sea shells (oyster, clam etc.). Highly organic mineral strata may occur in the Cg horizon in which the dried soil reaction may be very strongly or extremely acid.

Competing Series and Their Differentiae: These include the Deunggu, Gimhae, Jeonbug, Buyong, Daldong, Hagseong and Mangyeong series. The Deunggu and Gimhae soils have fine silty textures and contain iron sulfates. The Jeonbug soils have browner colors and imperfect drainage. The Buyong soils have fine clayey textures and lack sea shells in the substrata. The Daldong soils have sandy substrata textures and imperfect drainage. The Hagseong soils have sandy substrata. The Mangyeong soils have coarse loamy textures and lack sea shells in the substrata.

Setting: The Deogha soils occur on level to nearly level fluvio-marine plains. Dominant slopes are 0 to 1 percent and the range is less than 2 percent.

Principal Associated Soils: These are the Hagseong, Daldong, Buyong and Mangyeong soils. All of these soils are associated on fluvio-marine plains. The Daldong soils occur in slightly higher physiographic positions.

Drainage and Permeability: Poorly drained. Permeability is moderately slow or slow and runoff is very slow except where artificially controlled.

Use and Vegetation: These soils are used for flood irrigated paddy rice. Some of the artificially drained areas are also used for barley.

Distribution and Extent: The Deogha soils are of small extent and are distributed in southern and eastern coastal plains of the country.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966.

Remarks: The clay increase between 25 and 80 cm. in the typifying pedon is considered due largely to stratification. The drainage of this series was considered as imperfect before placement in the new classification system because double crops can be grown.

Lab. Nos. U549-553 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05 .002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02 .002	Textural Class
0- 13	Ap1g	0.9	0.3	1.2	3.1	7.6	5.7	57.4	24.7	SiL	6.1	29.8	39.4	CL
13- 23	Ap2g	0.7	0.4	1.3	3.6	8.6	6.8	54.9	24.4	SiL	7.1	29.7	38.8	CL
23- 50	B1g	0.3	0.4	0.9	2.8	6.8	4.9	54.3	29.9	SiCL	5.3	19.2	45.6	SiC
50- 80	B2g	0.2	——	2.0	——	4.2	3.5	54.0	36.3	SiCL	2.7	18.6	42.4	LiC
80-130	Cg	0.2	——	3.8	——	9.5	8.4	46.4	31.9	CL	5.2	32.9	30.0	LiC

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
	35.7	13.3	4.9	-	1.90	11.08	5.0	1.20	0.32	0.16	-.	60.0	-
	33.4	13.9	5.3	-	1.77	14.18	5.6	2.90	0.60	0.24	-	66.0	-
	31.0	19.3	6.2	5.1	1.67	16.68	6.5	3.50	1.28	0.56	-	71.0	-
	32.3	19.4	6.3	5.1	1.55	17.08	6.7	4.50	2.40	1.28	-	87.0	-
	27.5	17.1	3.8	3.5	2.89	52.60	32.0	4.20	0.68	0.35	-	72.0	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
4 November, 1969

DEUNGGU SERIES

The Deunggu series is a member of the fine silty, mixed, acid, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick grayish brown silty clay loam Apg horizons and moderately deep gray silty clay loam Bg horizons with common prominent yellowish iron sulfate mottles and strongly acid reaction. The Cg horizons are dark gray weakly stratified very fine sandy loam or fine sandy loam with neutral field reaction. These soils occur in recent alluvium on broad nearly level fluvio-marine plains.

Typifying Pedon: Deunggu silty clay loam - rice (Field description Gimhae Gun profile No. 2; colors are for moist soil.)

Ap1g -- 0 to 8 cm. Gray (5Y 5/1) moist silty clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; puddled structure, breaking to weak fine to medium granular; slightly sticky and slightly plastic; common fine random tubular pores; many fine rice roots; abrupt smooth boundary; pH 6.0.

Ap2g -- 8 to 16 cm. Gray (5Y 5/1) silty clay loam; moderate prominent yellowish red (5YR 5/6) mottles; weak coarse platy and weak coarse subangular blocky structure; clear wavy boundary; pH 6.3.

Ap3g -- 16 to 25 cm. Gray (5Y 5/1) silty clay loam; common medium to fine prominent strong brown (7.5YR 5/8) mottles; weak coarse prismatic structure, breaking to coarse platy and weak medium subangular blocky; firm, sticky and plastic; common fine vertical inped simple tubular pores and dead rice roots; clear smooth boundary; pH 6.3.

B21g -- 25 to 55 cm. Dark gray (10YR 4/1) silt loam; many fine to medium prominent strong brown (7.5YR 5/6) mottles; crushed color dark grayish brown (10YR 4/2); weak coarse prismatic structure with gray thin patchy clayey cutans; firm, sticky and plastic; clear wavy boundary; pH 5.5.

B22g -- 55 to 100 cm. Gray (10YR 5/1) silt loam; many fine to medium prominent yellow (10YR 8/6) iron sulfate, dark reddish brown (5YR 2/2) and strong brown (7.5YR 5/6) mottles; structure as above becoming less distinct with depth; slightly sticky and slightly plastic; many very fine white mica; common partly decayed reed stems and roots; clear smooth boundary; pH 5.5.

Cg -- 100 to 150 cm. Dark gray (5Y 4/1) very fine sandy loam; few medium prominent dark brown (7.5YR 5/2) mottles; structureless; many sea shells (oyster, clam etc.) below about 2 meters; pH 7.0; (No samples taken).

Type Location: Gimhae Eup, Gyeongsangnam Do, 1 km. south of Gimhae radio transmission station.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is probably greater than 5 meters. Base saturation is more than 60 percent throughout the profile. Solum reaction is strongly acid except where limed. Common fine mica occurs throughout the profiles. Clay content ranges between 18 and 35 percent in the control section with less than 15 percent coarser than very fine sand. The Apg horizons are moderately thick gray, grayish brown or dark grayish brown silty clay loam, light silty clay or silt loam with prominent strong brown and yellowish red mottles. The cambic Bg horizons are moderately deep, gray, dark gray or dark grayish brown silty clay loam, silt loam or loam with common or many prominent yellowish red, strong brown or red mottles above 50 cm. depths. Yellowish iron sulfate mottles dominate between 50 and 100 cm. depths where the reaction is strongly to extremely acid. Cg horizons are gray or dark gray weakly stratified silt loam, loam, fine sandy loam or very fine sandy loam with few or no mottles, less than 18 percent clay and neutral to moderately alkaline field reaction and strong to extremely acid dry soil reaction.

Competing Series and Their Differentiae: These are the Daldong, Deogha, Jeonbug, Gimhae, Bongrim and Haecheog series. The Daldong soils have fine silty over sandy textures, more mottles and imperfect drainage. The Deogha soils have sea shells in the Cg horizons. The Jeonbug soils have more mottles and imperfect drainage. The Gimhae soils have Cg horizons with more than 18 percent clay have yellow sulfate mottles above 50 cm. and dry out to somewhat greater acidity. The Bongrim soils are more poorly drained, and have grayer colors throughout the Cg horizons, with 18 to 35 percent clay. The Haecheog soils are very poorly drained, and have grayer colors.

Setting: The Deunggu soils occur on nearly level fluvio-marine plains. Slopes are less than 2 percent and average less than 1 percent.

Principal Associated Soils: In addition to the competing series, the Myeongji soils are associated. The Myeongji soils have sandy textures, less gray colors and are moderately well drained. They occur on levees near the sea.

Drainage and Permeability: Poorly drained. Runoff is slow to very slow except where artificially controlled. Permeability is slow or very slow.

Use and Vegetation: These soils are used for flood irrigated rice during the wet summer seasons and where sufficiently drained some barley is grown during the dry winter seasons.

Distribution and Extent: The Deunggu soils are of small extent and occur in southern part of the country on fluvio-marine plains.

Series Established: Gimhae Gun, Gimhae Eup, Gyeongsangnam Do, 1968.

Remarks: The Deunggu series is one of the so called Acid Sulfate soils in Korea on fluvio-marine plains in which the solum reaction decreases 1.0 to 2.0 points on drying. The Cg horizons may descrease even more. The drainage of this series was considered as imperfect before placement in the new classification system because double crops can be grown.

Lab. Nos. G156-60 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 8	Ap1g	0.0		1.8		1.4	2.6	53.3	40.9	SiC	1.9	10.7	46.5	SiC
8- 16	Ap2g	0.0		1.7		1.6	2.1	55.5	39.1	SiCL	1.8	12.3	46.8	SiC
16- 25	Ap3g	0.0		2.9		3.8	4.3	52.1	36.9	SiCL	3.3	14.8	45.0	SiC
25- 55	B21g	0.0	0.4	0.8	1.4	8.9	9.7	52.5	26.3	SiL	3.1	31.8	38.8	LiC
55-100	B22g	0.0	0.4	0.9	3.0	22.2	16.7	39.4	18.0	L	5.9	50.5	25.6	CL

Moisture Retention %			Bulk Density g/cc	pH		O.M. %	Avail. P_2O_5 ppm	Free Fe_2O_3 %	2/ CEC	Extractable Cations				
1/10 atms	1/3 atms	15 atms		H_2O (1:1)	1 N KCl				me/100g	Ca	Mg	Na	K	H
52.7	43.5	30.1	-	4.9	3.7	2.57	8	1.78	12.80	3.50	3.90	1.75	0.30	1.38
50.0	41.0	29.3	1.38	4.9	3.7	2.38	14	1.86	13.10	3.90	4.15	1.40	0.35	0.81
47.1	39.0	26.3	1.38	4.9	3.7	1.67	8	1.91	14.90	3.90	4.90	1.45	0.53	1.52
43.3	34.8	22.6	1.14	4.6	3.4	1.14	8	1.31	12.90	3.10	3.65	1.45	0.50	2.48
36.5	28.4	14.3	-	4.9	3.6	0.81	14	1.01	9.50	2.65	3.10	1.15	0.38	1.29

Base Saturation %	
CEC	Sum of Cations
73.8	87.3
74.8	92.4
72.3	87.6
67.4	77.8
76.6	84.9

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KPJ, JFD
3 November, 1969

GAGHWA SERIES

The Gaghwa series is a member of the fine clayey, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have thin brown to dark brown cobbly clay loam A horizons and yellowish red cobbly clay loam or cobbly clay Bt horizons. They are developed on very deep moderately dissected mountain colluvial and fan terraces.derived from acidic crystalline or similar materials.

Typifying Pedon: Gaghwa clay loam, eroded - cultivated upland crops (Field description Gwangsan Gun profile No. 57; colors are for moist soil.)

Ap -- 0 to 9 cm. Brown (7.5YR 5/4) gravelly light clay loam; moderate fine to medium granular structure; friable, slightly sticky and slightly plastic; few fine mica; abrupt smooth boundary.

B21t -- 9 to 43 cm. Yellowish red (5YR 4/8) gravelly clay loam; moderate fine to medium subangular blocky structure; friable, sticky and plastic; approximately 10 percent slightly to moderately weathered granite gravel and cobbles; few fine mica; gradual smooth bounary.

B22t -- 43 to 89 cm. Yellowish red (5YR 4/8) cobbly clay loam; moderate medium subangular blocky structure; friable, sticky and plastic; patchy thin clay cutans; approximately 20 percent slightly to moderately weathered granite cobbles; few fine yellow and white mica; gradual smooth boundary.

B3 -- 89 to 100 cm. Yellowish red (5YR 5/6) cobbly light clay loam; structureless (massive); approximately 40 percent slightly weathered granite gravel and cobbles; common fine mica.

Type Location: Deungcheon Ri, Chungpung Dong, Gwangju City, Jeollanam Do.

Range in Characteristics: Solum thickness is commonly about 1 meter ranging from 90 cm. to 130 cm. Depth to hard rock is greater than 2 meters ranging from about 1.5 to more than 5 meters. Solum reaction ranges mainly from strongly to medium acid except where limed. Base saturation is usually less than 35 percent in the control section. A horizons are brown to dark brown loam to clay loam with varying amounts of cobbles, gravel and stones, except that where cultivated they have generally been removed. Where eroded A horizons are chiefly strong brown or yellowish red clay loam, silty clay or clay with some coarse fragments. B2t horizons are commonly yellowish red or red clay loam,clay or silty clay with 7 to 35 percent gravel, cobbles and some stone. Clay content of the B2t horizon ranges from 35 to 60 percent. C horizons are dominantly yellowish red or strong brown mottled with red, brown and yellowish brown cobbly or very cobbly and gravelly stratified fine earth becoming coarser with depth.

Competing Series and Their Differentiae: Closely related or similar soils include the Mitan, Pyeongan, Ungyo, Banggi, Bancheon, Jangweon, Seogto and Banho series. The Mitan soils have near neutral reaction and occur in limestone areas. The Pyeongan soils have fine clayey textures and are formed in colluvium from limestone soils. The Ungyo soils have fine clayey textures, dark A horizons high in organic matter and are formed in granitic colluvium. The Banggi soils have clayey skeletal textures, more than 35 percent mostly gravel size fragments, are on stream terraces, and are derived from old alluvial materials. The Bancheon soils are essentially free of coarse fragments in the solum. The Jangweon soils have fine loamy textures and yellower subsoils containing fragipan horizons. The Banho soils have fine loamy textures, browner and less red colors, are more friable and occur in association with the grayish brown shale soils.

Setting: The Gaghwa soils occur on sloping to moderately steep, dissected, colluvial slopes and some fan terraces. Dominant slopes are between 10 and 25 percent and the range is from 7 to 35 percent. The regolith is mostly weathered old colluvium containing more or less homogeneous soil materials and coarse fragments with little stratification,derived from granite, gneiss, schists andesite porphyry and similar materials.

Principal Associated Soils: In addition to the competing series, the Mudeung, Samgag, Dalcheon and Bonggye soils may be associated. The Mudeung and Samgag soils occur on steep residual mountain slopes above the Gaghwa soils. The Seogto soils are deep, have loamy skeletal textures and occur in depressions above and beside the Gaghwa soils. The residual fine clayey Dalcheon and Bonggye soils are associated in higher landscape positions.

Drainage and Permeability: Well drained. Runoff is medium to rapid. Permeability is moderately slow or slow.

Use and Vegetation: Most of these soils are used for upland crops such as barley, sesame, radish and soybean. About one-third grows pine forest, scrub and wild grass.

Distribution and Extent: The Gaghwa soils occur on mountain colluvial slopes and fan terraces in granite, granite gneiss and areas of similar materials throughout the country. These soils have large extent though individual areas may be relatively small.

Series Established: Cheongog Dong, Gwangju City, Jeollanam Do, March 1967.

Remarks: The range in base saturation in this and similar soils is mostly between 15 and 35 percent however, in many places it is more. As there appears to be no way to separate these soils in the field at the 35 percent level, they are placed in the Typic Subgroups and the portion above 35 percent in base saturation is considered as a taxonomic inclusion.

Lab. Nos. K62-65 Typifying Pedon

			Particle Size Distribution 1/ (mm) %												
			U. S. Department of Agriculture								International				
Depth cm	Horizon	Gravel >2mm	VCS 2–1	CS 1–.5	MS .5–.25	FS .25–.10	VFS .10–.05	Silt .05–.002	Clay <.002	Textural Class	CS 2–.2	FS .2–.02	Silt .02–.002	Textural Class
0– 9	Ap	10.4	3.3	9.4	10.4	8.8	3.7	36.9	27.5	CL	25.7	22.8	24.0	LiC
9– 43	B21t	11.4	3.2	7.9	9.0	7.6	3.2	36.3	32.8	CL	21.9	18.7	26.6	LiC
43– 89	B22t	10.5	2.1	7.1	9.6	8.8	4.0	29.6	38.8	CL	21.0	22.7	17.5	LiC
89–100	B3	7.8	2.6	9.2	12.1	11.3	5.4	30.7	28.7	CL	26.6	27.1	17.6	LiC

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Sat.	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g						
	25.1	12.9	5.4	4.0	4.00	6.70	2.45	1.15	0.10	0.91	–	68.8	–
	24.2	12.8	5.0	3.7	1.40	11.20	0.40	0.15	0.14	0.28		8.7	–
	24.1	15.0	4.8	3.6	1.00	8.70	1.15	0.60	0.24	0.14	–	24.5	–
	25.9	15.3	4.9	3.6	0.20	13.40	0.40	0.50	0.25	0.11	–	9.4	–

Elemental Analysis of Clay					3/
SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	CEC me/100g
–	–	–	–	–	–
1.68	46.61	10.74	40.11	1.58	27.58
–	–	–	–	–	–
1.77	48.51	9.65	40.43	1.30	26.07

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, NaCl Extracted

Established Series
UKT, JYH, JFD
18 November, 1969

GANGDONG SERIES

The Gangdong series is a member of the fine loamy over sandy, mixed, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick grayish brown or gray loam or silt loam Apg horizons, moderately deep dark gray loam or silt loam cambic Bg horizons and dark gray or olive gray stratified sandy loam, loamy sand or sand Cg horizons below 50 to 100 cm. They occur on nearly level to very gently sloping broad continental alluvial plains and in gently sloping to sloping local alluvial valleys.

Typifying Pedon: Gangdong loam - rice paddy (Field description Sangju Gun profile No. 248; colors are for moist soil.)

Ap1g -- 0 to 5 cm. Grayish brown to dark grayish brown (2.5Y 5/2 to 4/2) silt loam; few coarse distinct dark gray (5Y 4/1) mottles; crushed color olive gray (5Y 5/2); puddled, structureless (massive); friable, slightly sticky and slightly plastic; common fine mica; common fine to medium dead rice roots; abrupt smooth boundary; pH 6.5.

Ap2g -- 5 to 25 cm. Dark gray (5Y 4/1) silt loam; few fine distinct olive brown (2.5Y 4/4) mottles; structureless (massive) breaking to weak coarse platy; slightly sticky and plastic; common fine white mica; common fine to medium dead rice roots; gradual smooth boundary; pH 6.5.

B1g -- 25 to 40 cm. Dark gray (5Y 4/1) light clay loam; few fine distinct olive brown (2.5Y 4/4) inmass mottles; moderate coarse prismatic structure; slightly firm, slightly sticky and plastic; common fine white mica; few fine discontinuous random exped vesicular tubular pores; few fine dead rice roots; clear smooth boundary; pH 6.5.

B2g -- 40 to 70 cm. Very dark gray (5Y 3/1) light clay loam; weak coarse prismatic structure; firm, very sticky and very plastic; common fine white mica; clear smooth boundary; pH 6.5.

Cg -- 70 to 120 cm. Dark gray (5Y 4/1) sand and loamy sand stratified; structureless (single grain); common fine mica; pH 7.0.

Type Location: Sangju Gun, Gyeongsangbug Do, Daehyeon Ri, approximately 3 km. south of Cheongri Myeon and 1.5 km. northeast of Sinchon, 100 meters east of the junction of the motor road and railroad.

Range in Characteristics: The solum thickness ranges from 50 to 100 cm. Depth to hard rock is greater than 2 meters and probably more than 5 meters. Reaction is strongly acid to slightly acid, except where limed. The Apg horizons are grayish brown, gray, dark gray or dark grayish brown loam or silt loam with olive gray, olive brown and or yellowish brown mottles. The Bg horizons are gray, dark gray, very dark gray or dark olive gray loam, silt loam or sandy loam with distinct or prominent mottles. Few ferrous carbonate ($FeCO_2$) mottles may occur. The Cg horizons are gray to dark gray sand, loamy sand or sandy loam sometimes stratified with silty clay loam, fine sandy loam and or silty clay loam beginning between 50 cm. and 100 cm. and extending below 150 cm. Fine mica is generally common throughout the profile though it ranges from few to many.

Competing Series and Their Differentiae: These include the Baeggu, Hamchang, Jisan, Sugye, Sindab, Subug, Bonryang, Manseong and Yeongsan soils. The Baeggu soils differ in having deep fine loamy textures. The Hamchang soils belong to the coarse loamy texture family. The Jisan soils are imperfectly drained, contain more brown colors, more brown mottles and have fine loamy textures throughout the profiles. The Sugye soils are in the fine silty texture family. The Sindab soils are in the sandy texture family. The Subug soils have shallow coarse loamy textures over sandy skeletal substrata. The Bonryang soils are well drained, free of gray mottles in the solum and have moderately deep coarse loamy textures over sandy substrata. The Manseong soils are imperfectly drained, have more brown colors, more brown mottles and have moderately deep fine loamy textures over sandy substrata. The Yeongsan soils are imperfectly drained.

Setting: The Gangdong soils are on nearly level, very gently sloping and gently sloping broad alluvial plains with high water tables and in local alluvial valleys where seepage water and high water tables occur. Slopes ranges from 0 to 2 percent on the broad alluvial plains and from 2 to 10 percent in local valley areas.

Principal Associated Soils: The Yeongsan, Hamchang, Sinheung and Manseong soils are associated on the alluvial plains near stream channels. The Subug and Jisan soils are associated in local valleys. The Dalcheon, Samgag and similar soils are associated in uplands.

Drainage and Permeability: Poorly drained. Runoff is slow to very slow and permeability is probably moderately rapid. The water table is generally in or near the surface except where artificially controlled.

Use and Vegetation: Essentially all areas are used for one annual crop of flooded paddy rice.

Distribution and Extent: The Gangdong soils are of moderate extent and occur on broad alluvial plains and in local valleys throughout most granitic areas of the country.

Series Established: Gwangsan Gun, Jeollanam Do, Gangdong Ri, Songjeong Eup, March 1967.

Remarks: The Bg horizons in the typifying pedon have somewhat grayer colors and finer textures than is typical for the series.

Lab. Nos. Fr234-238 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 5	Ap1g	0.6	3.0	7.7	11.7	11.9	9.0	38.5	18.2	L	24.1	34.4	23.3	CL
5- 25	Ap2g	0.3	6.1	9.8	11.9	11.0	8.7	36.3	16.2	L	29.2	31.4	23.2	CL
25- 40	B1g	3.3	5.6	9.4	11.1	8.6	9.1	39.0	17.2	L	27.4	30.1	25.3	CL
40- 70	B2g	0.7	2.7	6.4	7.8	2.1	15.4	42.1	23.5	L	18.3	29.6	28.6	CL
70-120	Cg	14.3	5.9	13.2	28.2	17.9	20.8	11.5	2.5	S	52.4	40.0	5.1	S

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations Ca	Mg	Na	K	H	Base Sat. % CEC	Sum of Cations
							me/100g							
41.7	35.6	11.4	5.5	4.3	3.99	28	8.80	5.90	2.00	0.30	0.18	0.15	95.2	98.2
38.7	34.2	10.9	5.5	4.3	4.10	26	8.75	5.85	1.65	0.23	0.10	0.15	89.5	98.1
39.0	31.8	11.9	5.5	4.3	4.62	16	6.75	6.90	1.65	0.58	0.10	0.15	136.7	98.4
38.2	32.6	12.0	5.6	4.2	3.28	16	8.55	4.65	1.85	0.28	0.10	0.15	80.5	97.9
15.1	10.0	2.6	6.1	4.8	2.05	30	2.80	2.00	0.70	0.13	0.08	0.05	103.9	98.3

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JCH, JFD
27 October, 1969

GEUGRAG SERIES

The Geugrag series is a member of the fine clayey, mixed, mesic family of Aeric Fluventic Ochraqualfs (Red-Yellow Podzolic soils with high base status intergrading to Low-Humic Gley soils). The soils of this series have moderately thick grayish brown silty clay loam Apg horizons in paddy, yellowish brown or dark yellowish brown silty clay loam upper Bt horizons mottled with light gray; gray silty clay lower Btg horizons mottled with yellowish brown and gray silty clay loam or silty clay Cg horizons mottled with dark yellowish brown or very dark brown. This series occurs on low continental river terraces.

Typifying Pedon: Geugrag silt loam - rice paddy (Field description Gimje Gun profile No. 118; colors are for moist soil.)

Ap1g -- 0 to 10 cm. Gray (10YR 5/1) silt loam; common medium distinct strong brown (7.5YR 5/6) inmass mottles along common fine to medium vertical and some random root holes and pores; puddled massive breaking to weak fine and medium granular; friable, slightly sticky and slightly plastic; many fine rice roots; abrupt smooth boundary; pH 4.5.

Ap2g -- 10 to 22 cm. Distinctly mottled light gray (10YR 6/1), yellowish brown (10YR 5/8) and dark yellowish brown (10YR 4/4) silt loam; common coarse yellowish red (5YR 4/6) and common medium strong brown (7.5YR 5/6) mostly exped mottles; crushed color light olive brown (2.5Y 5/4); firm, slightly sticky and slightly plastic; weak coarse prismatic structure breaking to weak fine platy in the lower part; common fine to coarse discontinuous simple tubular pores; common fine rice roots; clear smooth boundary; pH 5.0.

B21t -- 22 to 43 cm. Dark yellowish brown (10YR 4/4) silty clay; many coarse faint brown to dark brown (10YR 4/3) and distinct yellowish brown (10YR 5/8) inprism mottles; firm, sticky and plastic; thick continuous distinct light gray (10YR 6/1-5/1) exprism cutans; moderate coarse prismatic structure breaking to moderate coarse and medium subangular blocky; crushed color dark yellowish brown (10YR 4/4); few fine discontinuous simple tubular pores; few fine rice roots; clear wavy boundary; pH 6.5.

B22t -- 43 to 88 cm. As above yellowish brown (10YR 5/8) clay; firm, sticky and plastic; thick continuous distinct dark gray (10YR 4/1) exprism cutans and common faint and distinct inped mottles; pH 5.2.

B23tg -- 88 to 150 cm. Gray (10YR 5/1-4/1) silty clay; very firm, sticky and plastic; inped mottles as above; prismatic structure breaks to weak coarse platy in upper part of this horizon; pH 5.7.

Type Location: Gimje Gun, Jeollabug Do, Sinho Ri, Bongnam Myeon, 500 meters south Bongnam Primary School.

Range in Characteristics: Solum thickness is more than 125 cm. and the Cg horizon thickness ranges from two to three meters or more. Reaction ranges from strongly acid to slightly acid, generally increasing slightly with depth. Base saturation is more than 60 percent. Apg horizons are gray, grayish brown, dark grayish brown heavy silt loam or silty clay loam with common or many yellowish brown, dark yellowish brown or strong brown mottles due to reduction under paddy irrigation. B2t horizons are yellowish brown, dark yellowish brown, brown or dark brown silty clay or heavy silty clay loam with common or many light gray to gray mottles. B3tg horizons are dominantly gray silty clay loam, silty clay or clay loam with yellowish brown or dark yellowish brown inped mottles and usually with black or dark brown soft manganese concretions. Characteristically, the Bt horizons have coarse prismatic structure with continuous gray clayey cutans in the upper part resulting, at least in part, from cracks formed in the dry season being partly filled with gray fine materials from the surface when irrigated and cultivated. Consistence is firm or very firm. Cg horizons are gray stratified clayey alluvium.

Competing Series and Their Differentiae: These are the Hwadong, Gongseong, Honam, and Jangyu series. The Hwadong and Gongseong series have Bt horizons with dominant hues of 7.5YR or 5YR and have at least one Bt horizon free of gray mottles. The Honam series has hues of 2.5Y and chromas of 2 or less. The Jangyu series has redder B horizons than the Geugrag and contains more than 35% gravel. The Geugrag series is similar in texture to the Hwadong and Honam series but occupies a drainage position between them.

Setting: The Geugrag soils occur on level to nearly level slightly dissected low river terraces in broad continental alluvial valleys and some broad plains where dominant slopes range less than 2 percent. Terrace edges are mostly less than 7 percent slopes. Except where protected by dykes, areas may be subject to infrequent flooding hazards.

Principal Associated Soils: These soils occur at lower elevations and have more yellow hues than the redder Hwadong and Pancheon soils. They are at higher elevations than the grayer Honam, Sugye or Hamchang soils. They are sometimes adjacent to but at higher elevations than the coarse loamy Bonryang soils on recent alluvial floodplains.

Drainage and Permeability: The Geugrag soils occupy the better drained portion of the imperfectly drained class. They are very slowly permeable and runoff is slow. The artificially controlled watertable fluctuates between 50 and 100 cm. during most seasons.

Use and Vegetation: Most areas are used for flooded paddy rice during the summer and about half for nonirrigated barley during the winter months.

Distribution and Extent: The Geugrag soils are of moderate extent and occur in the broader valleys mostly in the western and southern parts of Korea.

Series Established: Gwangju City, Gwangsan Gun, December 1966.

Remarks: Some question exists as to the drainage category of this series in the Comprehensive System of Soil Classification. The question is complicated somewhat by the merging of gray colors and reduction in the upper horizons due to flood irrigation (above about 40 to 50 cm.) with gray mottles and reduction in the main Bt horizons (between 50 and 100 cm.) due to the presence of fluctuating ground water tables. The most representative areas mapped to date are in Gimje Gun where the soils occupy drainage and terrace positions between the Hwadong and Honam series. In the Great Soil Group Classification it is considered to include the drainage range of the poorer drained portion of the moderately well and the better drained portion of the imperfectly drained categories. For purposes of the Comprehensive System of Soil Classification, it is considered as imperfectly drained due to the presence of some gray colors in all horizons.

Lab. Nos. Dm272-276 Typifying Pedon

			Particle Size Distribution 1/ (mm) %												
			U. S. Department of Agriculture								International				
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	Ap1g	0.0	—	3.9	—	2.7	13.9	64.2	15.3	SiL	4.5	37.2	42.8	CL
10- 22	Ap2g	0.0	—	2.7	—	2.0	2.3	72.7	20.3	SiL	3.1	33.4	43.2	CL
22- 43	B21t	0.0	—	0.5	—	1.0	1.6	55.2	41.7	SiC	0.8	19.7	37.8	LiC
43- 88	B22t	0.0	—	0.5	—	1.3	2.0	53.2	43.0	SiC	0.8	36.1	20.1	LiC
88-150	B23tg	0.0	—	1.0	—	2.9	4.8	55.9	35.4	SiCL	1.3	30.6	32.7	LiC

Moisture Retention %			Bulk	pH		O.M.	2/	Extractable Cations				
1/10 atms	1/3 atms	15 atms	Density g/cc	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H
							me/100g					
49.5	43.1	9.4	1.17	4.8	4.1	2.64	5.00	1.80	1.00	0.30	0.22	–
38.9	33.1	9.3	1.17	5.4	4.4	1.06	5.60	3.30	2.00	0.34	0.10	–
43.0	35.9	18.0	1.45	6.2	5.2	0.69	15.20	8.60	6.50	0.44	0.18	–
44.4	36.8	19.3	1.48	5.4	4.2	0.51	18.20	7.80	7.70	0.86	0.24	–
41.1	34.9	17.2	–	5.8	4.5	0.38	16.40	9.90	8.30	0.80	0.20	–

Base Saturation %	
CEC	Sum of Cations
3.32	–
5.74	–
15.72	–
16.60	–
19.20	–

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
4 November, 1969

GIMHAE SERIES

The Gimhae series is a member of the fine silty, mixed, acid, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick grayish brown silty clay loam Apg horizons and thick grayish brown silty clay loam very strongly acid cambic Bg horizons with many prominent yellowish and brownish mottles between 40 and 70 cm. The Cg horizons below about 70 cm. are dark gray silty clay loam or heavy silt loam with few mottles and near neutral field reaction. Dry soil reaction is extremely acid throughout except where limed. These soils are developed on broad moderately leached fluvio-marine plains.

Typifying Pedon: Gimhae silty clay loam - rice paddy (Field description Gimhae Gun profile No. 4; colors are for moist soil.)

Ap1g -- 0 to 12 cm. Gray (5Y 5/1) silty clay loam; few fine prominent strong brown (7.5YR 5/6) mottles; puddled, structureless (massive); friable, sticky and plastic; many fine dead rice roots; abrupt smooth boundary; pH 6.2.

Ap2g -- 12 to 26 cm. Gray to grayish brown (10YR 5/1.5) silty clay loam; common coarse prominent dark red (2.5YR 3/6) and yellowish red (5YR 5/8) exped mottles; crushed color brown to grayish brown (10YR 5/2.5); weak coarse platy structure; firm, sticky and plastic; many fine vertical inped simple tubular pores; clear smooth boundary; pH 4.7.

B1g -- 26 to 41 cm. Gray to grayish brown (10YR 5/1.5) silty clay loam; many coarse prominent dark reddish brown (5YR 3/4), common medium to coarse distinct yellow (10YR 5/6) and few medium prominent dark reddish brown (5YR 3/2) mottles along many medium semi-decayed reed stems and roots; stems inside are very dark red to brown; weak coarse prismatic structure; firm, sticky and plastic; clear smooth boundary; pH 4.5.

B2g -- 41 to 70 cm. Dark gray (5Y N4/) silty clay loam; few medium prominent very pale brown to yellow (10YR 7/5) mottles; structure as above; sticky and plastic; clear smooth boundary; pH 4.6.

C1g -- 70 to 100 cm. Dark gray to very dark gray (5Y N3/) silty clay loam; few medium to coarse prominent brown (10YR 5/3) mottles; structureless (massive); firm in place, sticky and plastic; common very fine mica; clear smooth boundary; pH 8.0.

C2g -- 100 to 150 cm. Dark gray to very dark gray (5Y N3/) loam; structureless (massive); firm, slightly sticky and plastic; no mottles; many mica; no samples collected.

Type Location: Gimhae Gun, Gyeongsangnam Do, about 100 meters south of Bongrim Ri, Garag Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. though 50 to 70 cm. is dominant. Base saturation is more than 60 percent. Reaction of the dried soil is extremely acid throughout the profile. Field reaction of the solum is very strongly or extremely acid except where limed and the substratum is near neutral. Apg horizons are gray, grayish brown or dark grayish brown silty clay loam or silt loam with mottles. The platy structure in the Ap2g is artificially formed to reduce permeability losses of irrigation water. The cambic Bg horizons are gray or grayish brown silty clay loam or silt loam with many prominent yellow, brown and few red iron sulfate mottles concentrated mainly between 40 and 70 cm., together with layers containing buried marsh reed stems and roots. Clay content is between 18 and 35 percent and less than 15 percent is coarser than very fine sand. The Cg horizons are dark gray, very dark gray or very dark grayish brown loam, silt loam or silty clay loam with 18 and 35 percent clay, few or no mottles and near neutral field reaction below 70 to 100 cm. These soils are formed in reclaimed moderately leached tidal marsh and tidal flat stratified fine silty and fine loamy fluvio-marine alluvial materials.

Competing Series and Their Differentiae: These are the Pongrim, Daldong, Deogha, Jeonbug, Deunggu and Haecheog soils. The Pongrim soils are less leached, contain yellow iron sulfate mottles in the upper Bg, have extremely acid field reaction above 50 cm. only, have grayer colors and are very poorly drained. The Daldong soils have fine silty over sandy textures, higher reaction and imperfect drainage. The Deogha soils have higher reaction and contain sea shells in the Cg horizons. The Jeonbug soils have higher reaction, more brown mottles and imperfect drainage. The Deunggu soils have coarse loamy textured Cg horizons, with less than 18 percent clay, fewer yellow iron sulfate mottles and somewhat less acid solum reaction. The Haecheog soils are less leached, have more yellow iron sulfide mottles, extremely acid reaction above 50 cm. depths, coarse loamy Cg horizons and very poor drainage.

Setting: The Gimhae soils occur on nearly level fluvio-marine plains with less than 2 percent slopes.

Principal Associated Soils: In addition to the competing soils, the slightly acid to neutral fine clayey Buyong soils free of yellow iron sulfate mottles are associated.

Drainage and Permeability: Poorly drained. Permeability and runoff are very slow except where artificially controlled. Depth to the watertable is 10 to 30 cm. in most areas due to rather limited development of the artificial drainage systems.

Use and Vegetation: Most of these soils are used only for flood irrigated rice. Small areas with somewhat better artificial drainage are also used for nonirrigated barley during the dry winter months.

Distribution and Extent: The Gimhae series is of moderate extent in the fluvio-marine plains in the southern and western parts of the country.

Series Established: Gimhae Gun, Gyeongsangnam Do, April 1968.

Remarks: The Gimhae series is one of the so called Acid Sulfate soils in Korea on fluvio-marine plains in which the solum reaction decreases about 1.0 on drying. It may also be considered as fine silty extremely acid moderately deep over neutral weakly stratified raw alluvium. The sulphur content is mostly less than 2.0 as given in the Final Report of Dr. B.C. Deb, Soil Chemist, UNKSOF, 1968. The drainage of this series was considered as imperfect before placement in the new classification system because double crops can be grown.

Lab. Nos. GI1-5 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori-zon	Gra-vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 12	Ap1g	0.0		1.3		0.8	1.7	59.7	36.5	SiCL	1.5	7.9	54.1	SiC
12- 26	Ap2g	0.0		2.7		1.0	1.3	58.9	36.1	SiCL	2.9	6.5	54.5	SiC
26- 41	B1g	0.0		1.6		1.2	1.9	57.4	37.9	SiCL	1.8	6.6	53.7	SiC
41- 70	B2g	0.0		1.8		1.5	3.9	61.0	31.8	SiCL	2.0	14.0	52.2	SiC
70-100	C1g	0.0		1.3		3.7	7.8	63.6	23.6	SiL	1.5	30.7	44.2	SiCL

Moisture Retention %			Bulk	pH		O.M.	Avail.	Free	2/	Extractable Cations				
1/10 atms	1/3 atms	15 atms	Density g/cc	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	Fe_2O_3 %	CEC	Ca	Mg	Na	K	H
									me/100g					
57.7	46.6	31.2	1.20	3.9	3.3	3.87	9	2.18	12.3	2.10	4.70	2.20	0.43	4.33
57.3	46.3	32.8	1.20	3.8	3.3	3.57	25	1.47	12.6	1.00	2.65	1.63	0.48	6.90
60.5	48.7	33.0	1.06	3.6	3.1	3.61	16	1.47	14.2	1.05	3.35	1.90	0.45	8.14
55.3	46.1	29.7	-	3.6	3.0	3.72	18	1.29	12.6	1.20	3.80	1.50	0.28	11.04
48.6	41.1	24.4	1.15	3.6	3.2	2.98	40	0.84	11.2	1.85	5.05	2.00	0.33	9.04

Base Saturation %	
CEC	Sum of Cations
76.7	68.5
45.7	45.5
47.5	45.3
53.8	38.1
82.4	50.5

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Methhd

Established Series
UKT, JJH, JFD
28 October, 1969

GIMJE SERIES

The Gimje series is a member of the fine clayey, mixed, non acid, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick grayish brown silty clay loam Apg horizons and moderately deep gray to dark grayish brown slightly acid to mildly alkaline silty clay cambic Bg horizons. Neutral Cg horizons are greenish gray silt loam to silty clay loam. A peaty layer less than 20 cm. thick occurs between 50 and 70 cm. The Gimje series is formed in alluvial materials on fluvio-marine plains.

Typifying Pedon: Gimje silty clay loam - rice paddy (Field description Gimje 6-5 profile No. 110 colors are for moist soil.)

Ap1g -- 0 to 9 cm. Light brownish gray (2.5YR 6/2) dry, grayish brown (2.5YR 5/2); silty clay loam; many fine to coarse prominent strong brown (7.5YR 5/8) and common fine to medium distinct yellowish brown (10YR 5/8) mottles; puddled, structureless (massive); hard, sticky and plastic; common discontinuous random inped dendritic tubular pores; many fine to medium dead rice and fine living grass roots; clear smooth boundary; pH 5.0; hardness 30.

Ap2g -- 9 to 18 cm. Gray to dark gray (10YR 5/1-4/1) dry, grayish brown (10YR 5/2); silty clay loam; many fine to medium prominent strong brown (7.5YR 5/8) mottles; crushed color light olive brown (2.5Y 5/4); weak medium to coarse platy structure; patchy thin clayey cutans; hard, sticky and plastic; common continuous random inped and exped vertical tubular pores; roots as above; clear smooth boundary; pH 5.5; hardness 26.

B1g -- 18 to 28 cm. Gray (10YR 5/1) silty clay; many distinct fine to medium yellowish brown (10YR 5/8) inped mottles; crushed color dark grayish brown (10YR 4/2); strong medium to coarse prismatic structure; continuous thick gray (10YR 5/1) clayey cutans; very firm, sticky and plastic; common fine to medium random inped and exped simple tubular pores; common roots as above; clear smooth boundary; pH 6.0; hardness 20.

B2g -- 28 to 49 cm. Gray (5YR 5/1) clay; many prominent medium to coarse brown to dark brown (7.5YR 4/4) and common prominent coarse to medium yellowish red (5YR 5/8) inped mottles; crushed color dark grayish brown (10YR 4/2); moderately coarse prismatic structure; continuous thick gray (5YR 5/1) clayey cutans; firm, very sticky and very plastic; pores as above; roots as above; abrupt smooth boundary; pH 6.0; hardness 18.

C1g -- 49 to 67 cm. Black (2.5Y N2/) silty clay loam; few coarse yellowish red (5YR 5/8) and few coarse reddish brown (7.5YR 4/4) inmass mottles; crushed color very dark gray (10YR 3/1); structureless (massive); firm, sticky and plastic; few pores as above; few roots as above; gradual smooth boundary; pH 6.0; hardness 17.

C2g -- 67 to 82 cm. Gray (10YR 5/1) silty clay loam; many prominent strong brown (7.5YR 5/6) inmass mottles; crushed color dark grayish brown (2.5Y 4/2); structureless (massive); sticky and slightly plastic; common coarse pores as above; few very fine mica flakes; fine to coarse dead reed roots and stems; clear smooth boundary; pH 6.0; hardness 18.

C3g -- 82 to 130 cm. Light greenish gray (10G 7/1) silt loam; many fine to coarse prominent yellowish brown (10YR 5/8) and common prominent medium to coarse yellowish red (5YR 5/8) inmass mottles; crushed color olive (5Y 5/3); firm, slightly sticky and nonplastic; pores as above; many fine mica flakes; roots as above; clear smooth boundary; pH 6.0.

C4g -- 130 to 250 cm. Greenish gray silt loam; no mottles; few coarse slightly decomposed reed stems, roots and woody pieces.

Type Location: Gimje Gun, Jeollanam Do, 500 m. East of Hagdong Ri, Baeggu Myeon, about 50 East of road.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. of fine clayey continental or leached fluvio-marine mineral soil overlying up to 20 cm. of buried peaty mineral soil which overlies greenish gray, bluish gray or gray fine clayey to fine silty fluvio-marine and continental materials, probably stratified and with significant salt content. The base saturation is generally more than 60 percent and the reaction is near neutral in the field but decreases somewhat when dried. The Apg horizons are grayish brown, gray, light brownish gray, olive gray or dark gray heavy silty clay loam to silty clay with hues of 2.5Y or 5Y, values of 4 to 6 and chromas of less than 2. Many to common yellowish brown, reddish brown, yellowish red and strong brown $FeCO_3$ mottles usually occur in the lower Apg and upper Bg horizons and diminish with depth. Silty clay Apg textures occasionally occur and farmers sometimes add sandy material to improve the workability. The cambic Bg horizons are grayish brown, gray or dark gray heavy silty clay loam, silty clay or clay with hues of 2.5Y or 5Y, values of less than 5 and chromas of 2 or less. Many or common olive, yellowish brown and some strong brown inped mottles may occur. The Bg horizons are weakly expressed as some alluvial stratification is evident and the characteristic moderate to strong prismatic structure with continuous gray clayey cutans is considered due mainly to cracks forming during dry seasons. The cutans are probably due mainly to the incorporation of Apg materials into prism cracks by cultivation and irrigation water. The peaty layers, occurring between 50 and 100 cm. depths, are mostly 10 to 20 cm. thick, black, dark gray or brown silty clay, heavy silty clay loam or light clay mineral soil with varying amounts of organic matter and peat which ranges from about 1.0 percent to 30 percent marsh reeds, roots and stems. The Cg horizons are commonly stratified silty clay to silt with hues of greenish gray 7.5GY to 10G, bluish gray 5BG to 10BG and gray N with values of 3 to 6 and chromas of 1 or less. Few or no mottles occur in the Cg horizons.

Competing Series and Their Differentiae: These are the Bongnam, Gongdeog, Jeonbug and Buyong series. The Bongnam soils belong to the same texture family but have a thicker peaty layer. The Buyong soils lack a peaty layer. The Jeonbug soils belong to the fine silty texture family and lack peaty layers. The Buyong soils have argillic Bg horizons.

Setting: The Gimje soils occur on level to nearly level middle and lower fluvio-marine plains, in back swamps and old channel positions where slopes are less than 2 percent.

Principal Associated Soils: These are Bongnam, Buyong, Gongdeog, Baeggu, Jeonbug and Mangyeong soils. The Gongdeog, Bongnam and Buyong soils occur in valley alluvial plains above the Gimje series. The Jeonbug and Mangyeong soils are associated on the broad fluvio-marine plains generally on the sea-ward side. The Baeggu soils in adjacent narrow local upland valleys are sometimes associated.

Drainage and Permeability: The Gimje soils have poor drainage, very slow permeability and very slow runoff. The water table, between 50 and 100 cm., is in and below the peaty layer most of the time except during the rainy season when paddy rice is produced. The water table and runoff are largely controlled by artificial methods.

Use and Vegetation: All areas are used for flooded rice paddy during wet summers and most areas are also used for nonirrigated barley during the dry winter and spring seasons.

Distribution and Extent: The Gimje soils are of moderate extent and occur in the south and south-west coastal plain areas.

Series Established: Gimje Gun, Jeonllabug Do, Hagdong Ri, Baeggu Myeon, May 1967.

Remarks: The sample analyses of this profile shows somewhat more acid reaction than typical below the organic layer. The high base saturation indicates the presence of free salts. This soil has in the past been considered imperfectly drained because it can be double cropped.

Lab. Nos. Dm232-239 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 9	Ap1g	0.0	—	2.1	—	1.1	1.3	59.5	36.0	SiCL	2.4	17.0	44.6	LiC
9- 18	Ap2g	0.0	—	3.3	—	1.0	0.8	55.8	39.1	SiCL	3.5	15.0	42.4	LiC
18- 28	B1g	0.0	—	0.4	—	0.4	0.5	36.5	62.2	C	0.5	1.9	35.4	HC
28- 49	B2g	0.0	—	0.3	—	0.4	0.6	43.1	55.1	SiC	0.4	7.6	36.9	HC
49- 67	C1g	0.0	—	0.2	—	0.3	5.6	66.7	27.2	SiCL	0.3	38.3	34.2	LiC
67- 82	C2g	0.0	—	0.2	—	0.3	4.6	73.8	21.1	SiL	0.3	38.5	40.1	CL
82-130	C3g	0.0	—	0.3	—	0.4	12.5	70.4	16.4	SiL	0.4	55.0	28.2	CL
130-250	C4g	0.0	—	0.2	—	0.5	13.0	73.4	12.9	SiL	0.3	68.4	18.4	FSL

Moisture Retention %			Bulk Density	pH		O.M.	2/ CEC	Extractable Cations				
1/10 atms	1/3 atms	15 atms	g /cc	H_2O (1:1)	1 N KCl	%		Ca	Mg	Na	K	H
							me/100g					
54.1	55.2	22.6	-	5.0	4.1	1.81	11.30	4.87	2.00	0.47	0.25	1.61
46.4	41.1	21.2	-	5.3	4.3	1.86	11.35	5.50	3.00	0.32	0.17	0.85
47.3	41.9	25.7	1.26	6.1	5.3	2.15	15.05	8.50	5.50	0.52	0.22	0.05
48.0	33.2	26.0	1.19	6.0	5.1	1.76	17.20	8.12	5.25	0.57	0.25	0.10
39.1	31.8	12.9	-	5.7	4.8	2.80	13.00	7.50	4.62	0.57	0.20	0.15
37.6	30.6	12.5	1.42	5.5	4.4	0.32	10.80	5.75	4.62	0.47	0.30	0.35
37.3	38.1	8.5	-	5.6	4.2	0.61	9.75	4.75	3.88	0.35	0.30	0.20
37.5	26.9	7.2	-	5.3	3.8	0.43	8.40	3.63	3.00	0.65	0.45	1.05

Base Saturation %	
CEC	Sum of Cations
67.1	82.5
79.2	91.4
97.9	99.7
82.4	99.3
99.1	98.8
103.0	97.0
95.2	97.9
92.0	88.0

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JCH, JFD
29 October, 1969

GONGDEOG SERIES

The Gongdeog series is a member of the fine clayey, mixed, nonacid, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick gray to dark gray silty clay loam Apg horizons and moderately deep gray to very dark gray silty clay loam cambic Bg horizons. They have a peaty mineral Cg layer below 50 to 75 cm. with thickness of more than 50 cm. The Gongdeog series is formed on nearly level alluvial plains in materials and physiographic positions transitional between continental and fluvio-marine deposits.

Typifying Pedon: Gongdeog silty clay loam - rice paddy (Field description Gimje Gun profile No. 93; colors are for moist soil.)

Ap1g -- 0 to 7 cm. Gray (5Y 5/1) silty clay loam; many fine to medium prominent yellowish red mottles mostly along root channels; puddled, structureless (massive); friable, sticky and plastic; many fine to medium discontinuous random inmass simple tubular pores; few fine and medium rounded quartz pebbles and fine mica; many fine and medium roots; abrupt smooth boundary; pH 5.0.

Ap2g -- 7 to 18 cm. Dark gray (5Y 4/1) silty clay loam; weak medium to coarse platy and subangular blocky structure; many fine to medium prominent yellowish red mottles along root channels and ped surfaces; friable, sticky and plastic; pores as above; quartz and mica as above; common fine and medium roots; abrupt smooth boundary; pH 6.0.

B1g -- 18 to 38 cm. Very dark gray (5Y 3/1) silty clay loam; weak coarse prismatic structure; common fine to medium prominent yellowish red (5YR 4/6), faint olive (5Y 5/4) and distinct olive brown (2.5Y 4/4) mottles in root channels and on most prism surfaces; sticky and plastic; common fine to medium continuous random inped tubular simple pores; quartz and mica as above; few fine roots; clear smooth boundary; pH 6.2.

B2g -- 38 to 53 cm. Gray (4/1) silty clay loam; structure as above; common medium to coarse faint olive (5Y 4/4) and many fine to coarse light gray (5Y 7/1) $FeCo_3$ mottles and concretions; firm, sticky and plastic; moderately thick broken clay cutans; pores as above; few fine to medium roots; abrupt smooth boundary; pH 6.3.

C1g -- 53 to 59 cm. Black (7.5YR N2/) silty clay; structureless (massive); firm, sticky and plastic; few pores as above; roots as above; abrupt smooth boundary; pH 6.5.

C2g -- 59 to 69 cm. Very dark gray (10YR 3/1) silty clay; structureless (massive); few pores as above; roots as above; abrupt smooth boundary; pH 6.0.

C3g -- 69 to 130 cm. Brown to dark brown (10YR 4/3), very dark brown (10YR 2/2), black (10YR 2/1) clay containing undecomposed woody, mucky and peaty materials; pH 6.0.

Type Location: Gimje Gun, Jeollabug Do, 500 meters southwest Baegsan Primary School, Ha Ri, Baegsan Myeon.

Range in Characteristics: Depth of silty clay loam mineral soil ranges from 50 to 100 cm. over a very thick peaty layer, generally more than 100 cm. thick but ranging from more than 50 cm. thick and extending below 125 cm. depths. Apg horizons are grayish brown, gray or dark gray loam to silty clay loam with many to common yellowish red, yellowish brown or reddish brown mottles. The Apg horizons range from 10YR through 5Y in hue, from 4 to 5 in value and 2 or less in chroma. The Bg horizons are dark grayish brown, dark gray and very dark gray heavy silty clay loam, silty clay or clay with many to common ferrous carbonate concretions and mottles. Bg horizons range from 2.5Y to 5Y in hue, from 3 to 5 in value and 2 or less in chroma. Reaction of the wet soil in the field is medium to slightly acid while reaction of the dry soil is strongly acid. Few to common fine mica flakes occur above the organic layer. The Cg peaty layers are black to dark brown with hues of 7.5YR to 10YR, values of 2 to 5 and chromas of 2 or less. Field reaction is neutral to medium acid. Organic matter content ranges up to 30 percent.

Competing Series and Their Differentiae: The Gimje, Buyong and Bongnam series have more brown mottles and poor drainage. The Gimje series has a thin organic substratum layer less than 20 cm. thick between 50 and 100 cm. depths. The Bongnam series has a moderately thick organic layer (20-50 cm. thick) at similar depths. The Buyong series lacks any organic layer. The Baeggu soils have fine loamy textures, more brown mottles and poor drainage.

Setting: The Gongdeog soils occur on nearly level to very gently sloping narrow valley alluvial plains transitional to broad fluvio-marine plains. Slopes are mostly 1 to 2 percent and range from 0 to 6 percent. At the Gongdeog series type location, the mean annual precipitation is about 1,240 mm., mean annual air temperature is about 12.4°C and the mean annual soil temperature is 14°C.

Principal Associated Soils: The Buyong and Baeggu soils are at slightly higher elevations in valley alluvial plains. The Bongnam and Gimje soils are commonly at slightly lower elevations in positions transitional to or on the broad fluvio-marine plains.

Drainage and Permeability: These soils have very poor drainage, very slow permeability and very slow runoff. The groundwater table is in or near the surface horizon most of the time except where artificially controlled.

Use and Vegetation: Essentially all agricultural areas are used for paddy rice. Some areas are used for temporary water reservoirs prior to transplanting rice. Improved artificial drainage is necessary for most dryland crops.

Distribution and Extent: The Gongdeog soils are of small extent and occur mainly in western and southern Korea.

Series Established: Gimje Gun, Jeollabug Do, November 1966.

Lab. Nos. Dm112-118 **Typifying Pedon**

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) %: U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 7	Ap1g	1.7	1.9	2.5	2.0	2.9	2.2	56.5	32.0	SiCL	8.0	18.3	42.7	LiC
7- 18	Ap2g	1.8	2.4	3.1	2.2	2.9	2.4	52.4	34.6	SiCL	8.3	12.7	44.4	LiC
18- 38	B1g	1.6	2.2	2.5	1.9	2.5	1.9	55.1	33.9	SiCL	7.2	17.4	41.5	LiC
38- 53	B2g	1.7	1.5	1.1	0.8	1.2	1.4	58.4	35.6	SiCL	3.7	13.4	47.3	SiC
53- 59	C1g	0.0	——	0.3	——	0.7	0.5	53.6	44.9	SiC	0.5	7.0	47.6	SiC
59- 69	C2g	0.0	——	0.2	——	0.6	0.4	46.7	52.1	SiC	0.4	4.9	42.6	HC
69-130	C3g	0.0	——	1.4	——	1.7	0.9	30.4	56.6	C	1.9	3.6	28.9	HC

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	Free Fe_2O_3 %	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	42.4	18.7	4.6	3.9	3.75	1.82	11.25	3.75	2.12	0.20	0.15	1.62	55.3	79.3
	39.0	19.3	5.3	4.3	3.64	1.98	12.00	4.88	2.88	0.22	0.12	0.51	67.5	94.1
	38.9	23.5	4.9	4.1	3.48	1.94	12.40	4.88	2.62	0.32	0.08	1.06	63.7	98.0
	41.2	18.6	5.1	4.2	4.81	1.94	14.90	5.25	2.62	0.22	0.08	0.51	54.8	94.1
	42.9	21.1	4.6	3.7	10.45	0.76	23.20	5.12	3.13	0.30	0.15	1.42	37.5	86.0
	41.0	21.5	4.4	3.7	9.52	0.58	22.65	5.25	3.62	0.30	0.25	1.51	41.6	86.2
	-	-	4.9	4.2	30.50	0.98	48.00	5.38	3.88	0.35	0.20	0.61	20.4	94.1

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JJH, JFD
12 November, 1969

GONGSEONG SERIES

The Gongseong series is a member of the fine clayey, mixed, mesic family of Aquic Hapludalfs (Red-Yellow Podzolic soils with high base status). These soils have thin brown to dark brown silty clay loam A horizons, moderately thick strong brown friable silty clay loam upper Bt horizons and very thick yellowish red firm silty clay lower Bt horizons with pale brown or grayish brown mottles. C horizons are yellowish brown silty clay loam with gray mottles. This series is formed in stratified old alluvium on moderately elevated river terraces.

Typifying Pedon: Gongseong silty clay loam - barley in an area recently leveled for rice paddy (Field description Sangju Gun profile No. 187P; colors are for moist soil.)

Ap -- 0 to 10 cm. Yellowish brown (10YR 5/8) silty clay loam; weak fine subangular blocky structure breaking to granular; friable, sticky and plastic; common very fine and medium continuous oblique exped dendritic tubular pores; common fine living barley roots; abrupt smooth boundary; pH 5.5.

B21t -- 10 to 30 cm. Strong brown (7.5YR 5/6) silty clay loam; thin discontinuous yellowish red (5YR 4/8) clay cutans; common coarse black exped soft manganese concretions and films; strong brown (7.5YR 5/6) when crushed; strong fine and medium angular blocky structure; firm, very sticky and very plastic; few very fine discontinuous oblique inped tubular simple pores; few very fine living roots; gradual wavy boundary; pH 5.0.

B22t -- 30 to 50 cm. As above clay with more yellowish red (5YR 5/6) and less strong brown colors; yellowish red (5YR 5/8) when crushed; clear wavy boundary; pH 5.0.

B23t -- 50 to 80 cm. Yellowish brown (10YR 5/8) silty clay; common coarse faint light gray (10YR 7/1) exped mottles; strong brown (7.5YR 5/6) when crushed; strong medium and coarse angular blocky structure; very firm, very sticky and very plastic; broken thin strong brown (7.5YR 5/6) clay cutans; few fine and medium discontinuous random inped vesicular closed pores; less roots than above; diffuse irregular boundary; pH 5.0.

B3t -- 80 to 150 cm. Yellowish red (5YR 5/8) clay; many coarse distinct light gray (10YR 7/1) and strong brown (7.5YR 5/6) exped mottles and clay cutans; yellowish red (5YR 5/8) when crushed; moderate medium and coarse angular blocky structure; firm, very sticky and very plastic; few fine and medium discontinuous random inped simple vesicular pores; no roots; pH 5.0.

C -- 150 to 200 cm. Mottled white (10YR 8/1), yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) clay loam; structureless (massive); firm, sticky and very plastic; no roots; no pores; field pH 5.0. Weakly stratified slightly gravelly old alluvium.

Type Location: Sangju Gun, Gyeongsangbug Do, 1/2 km. north east of Sangju Eup.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. Reaction ranges from very strongly to slightly acid except where limed. Base saturation is more than 60 percent throughout the profile. Thickness of the Ap or A1 horizon ranges from 10 to 20 cm. varying according to the landscape, land use and accelerated erosion. A horizons are yellowish brown, dark yellowish brown or brown to dark brown silt loam or silty clay loam. Areas used several years or more for paddy rice have grayish brown Apg horizons with high chroma mottles. The upper Bt horizons range from yellowish red to strong brown silty clay loam to silty clay. The main Bt horizons are similar with light gray, gray or light grayish brown probably relic mottles chiefly on prism and some ped faces. Strong platy structure breaking easily to medium angular blocky is characteristic of the lower Bt horizons. Clay content of the Bt horizon ranges between 35 and 60 percent. The C horizons range from yellowish brown or brownish yellow silty clay to silty clay loam with strata of silt loam, loam or sandy loam mottled with light gray and sometimes with gravel.

Competing Series and Their Differentiae: These are the Changpyeong, Bancheon, Wangsan, Pyeongan, Anyong and Hwadong series. The Changpyeong, Bancheon, Wangsan and Pyeongan series have similar or redder colors, better drainage and lack gray mottles in the lower subsoil. The Pyeongan soils also have darker A horizons and the Wangsan soils contain cobbles. The Gongseong soils are more leached chemically than the Hwadong soils, have more acid reaction and lack fluctuating ground water tables in the B3 horizons.

Setting: The Gongseong soils are on gently sloping to sloping moderate to strongly dissected alluvial terrace and fan terrace positions below the Anyong and Gaghwa soils on slopes ranging from 2 to 10 percent. Generally, these terrace remnants are separated from gravitational water sources by dissection.

Principal Associated Soils: Soils of the Hwadong series are at lower elevations. The Anyong and Jangweon soils are often adjacent at higher elevations nearer mountains on alluvial-colluvial fans. On adjacent terrace edges and escarpments, residual soils such as the Samgag and Songjeong series may occur.

Drainage and Permeability: The Gongseong soils are moderately well drained and very slowly permeable. Runoff is generally moderate. Ground water tables are several meters deep, probably in the buried saprolite.

Use and Vegetation: About 80 percent of the area of these soils is used for upland crops such as barley, soybean and mulberry. About 20 percent is rotated with irrigated rice during wet summers and non flood irrigated barley and vegetables during dry winter and spring seasons.

Distribution and Extent: The Gongseong soils are relatively inextensive though they occur throughout the larger valleys in the south and central parts of Korea.

Series Established: Sangju Gun, 20 February 1969.

Remarks:

Lab. Nos. Fr139-144 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 10	Ap	0.7	1.4	2.6	2.8	2.6	2.2	48.7	39.7	SiCL	7.1	14.5	38.7	LiC
10- 30	B21t	0.0	0.3	0.4	1.0	1.2	1.6	50.9	44.6	SiC	1.8	12.4	41.2	LiC
30- 50	B22t	0.0		1.8		2.1	2.6	46.4	47.1	SiC	2.0	12.8	38.1	HC
50- 80	B23t	0.0		1.3		2.6	3.4	43.3	49.4	SiC	1.5	15.2	33.9	HC
80-150	B3t	0.0		0.5		6.0	5.9	39.9	47.7	C	0.7	19.7	31.9	HC
150-200	C	0.0		5.2		10.9	10.7	39.2	34.0	CL	6.5	31.8	27.7	LiC

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg	Na	K	H
								me/100g				
36.6	30.7	14.7	1.34	5.3	4.0	0.74	10.60	4.60	3.30	0.18	0.35	-
36.2	33.4	16.6	1.52	5.4	3.8	0.14	11.80	4.60	3.20	0.18	0.18	-
38.1	31.8	17.6	-	5.4	3.8	0.11	11.65	3.90	3.75	0.13	0.18	-
39.3	32.9	19.3	1.44	5.4	3.8	0.11	13.70	4.20	3.55	0.25	0.18	-
43.7	38.4	22.4	-	5.0	3.9	0.11	14.80	5.70	3.65	0.23	0.18	-
36.6	30.8	15.6	-	5.1	3.8	0.11	9.35	4.65	2.75	0.38	0.15	-

Base Saturation % CEC	Sum of Cations
79.5	-
69.2	-
68.3	-
59.7	-
65.9	-
84.8	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
27 Aug. 1969

GWANAG SERIES

The Gwanag series is a member of the loamy skeletal, mixed, mesic family of Lithic Udorthents (Lithosols). These soils are shallow with thin brown to dark brown gravelly sandy loam A horizons and moderately thick pale brown very gravelly sandy loam C horizons over hard granitic bedrock.

Typifying Pedon: Gwanag gravelly sandy loam - pine forest (Field description Pyeongchang Gun profile No. 31; colors are for moist soil.)

A -- 0 to 9 cm. Brown (10YR 5/3) gravelly to cobbly sandy loam; fine to medium granular structure; friable, slightly sticky and nonplastic; many fine to medium grass and pine tree roots; about 60 percent slightly weathered granitic gravel and cobble; gradual smooth boundary; pH 5.5.

C -- 9 to 38 cm. Very pale brown (10YR 7/4) very gravelly to very cobbly sandy loam; weak fine to medium granular structure; friable, nonsticky and nonplastic; gravel and cobble as above; common fine to medium roots as above; abrupt wavy boundary; pH 5.7.

R -- 38 cm. Very pale brown hard granite bedrock.

Type Location: Pyeongchang Gun, Gangweon Do, about 4 km. east Ungyo bridge, Ungyo Ri, Bangrim Myeon.

Range in Characteristics: Depth to hard bedrock is 20 to 50 cm. None to 90 percent granitic outcrops may occur. 35 to 90 percent fine gravel and a few stones and cobbles occur throughout the control section. Base saturation varies considerably. Reaction is strongly to medium acid. A horizons are 5 to 20 cm. thick, brown, dark brown, very dark brown or very dark grayish brown or dark yellowish brown where eroded fine gravelly sandy loam or coarse sandy loam. C horizons are sandy loam, coarse loam or loam.

Competing Series and Their Differentiae: These are the Samgag, Mudeung, Odae, Daegu, Andong and Jangseong series. The Samgag soils have coarse loamy family textures, cambic B horizons and deeply weathered granitic saprolite. The Mudeung soils have fine loamy family textures and are derived from andesite porphyry materials. The Odae soils have dark colored A horizons. The Daegu soils have loamy skeletal family textures, high base saturation and are derived from shale materials. The Andong soils are similar except for having sandy textures and deeply weathered saprolite. The Jangseong soils have fine loamy textures, redder colors, high base status and limestone parent materials.

Setting: The Gwanag soils occur in steep and very steep mountainous and hilly areas underlain by coarse textured shallow weathered granitic materials. Slopes range from 10 to 100 percent. Dominant slopes are in the 40 to 75 percent range.

Principal Associated Soils: The Samgag and Seogto soils are associated in upland positions and the Jisan soils are associated in local alluvial positions.

Drainage and Permeability: Somewhat excessively drained. Permeability is rapid and runoff is medium or rapid after soil saturation. Horizontal subsurface water movement is probably moderate or rapid.

Use and Vegetation: Most areas grow red pine trees, wild grass, shrub and mixed forest. These soils have very limited value for useful vegetation.

Distribution and Extent: The Gwanag soils are of moderate extent and are distributed throughout the country in granitic mountainous areas.

Series Established: Pyeongchang Gun, Gangweon Do, November 1968.

Remarks: The Gwanag soils were included with the Samgag soils in earlier correlations.

Lab. Nos. Mh92-93 Typifying Pedon

Depth cm	Hori- zon	Gra- vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex- tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 9	A	58.4	18.0	10.1	8.1	7.9	8.8	35.4	11.4	CoSL	37.7	30.9	20.0	SL
9-38	B	59.5	21.2	14.9	10.6	8.7	10.2	27.5	6.9	CoSL	48.1	31.4	13.6	CoSL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	31.3	-	5.3	4.1	6.41	7.91	3.50	1.30	0.22	0.16	1.78	65.5	74.4
	20.8	7.6	5.6	4.3	2.57	3.04	1.90	0.60	0.16	0.14	0.64	92.1	81.4

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KBJ, JFD
30 October, 1969

GWANGHWAL SERIES

The Gwanghwal series is a member of the coarse silty, mixed, mesic family of Fluventic Haplaquept (Saline Alluvial soils). These soils have thin dark gray silt loam Apg horizons and very deep stratified greenish gray silt loam to very fine sandy loam Cg horizons. They are formed in recently reclaimed fluvio-marine plain alluvium with high salt content.

Typifying Pedon: Gwanghwal silt loam - rice paddy (Field description Gimje Gun profile No. 106; colors are for moist soil.)

Ap1g -- 0 to 9 cm. Dark gray (5Y 4/1) silt loam; few fine prominent yellowish red (5YR 4/8) and many fine to coarse prominent yellowish brown (10YR 5/6) mottles; crushed color olive gray (5Y 5/2); puddled, structureless (massive); friable, nonsticky and nonplastic; few fine to medium continuous vertical tubular simple pores; many fine mica flakes; abundant fine to medium roots; abrupt smooth boundary; pH 8.0.

Ap2g -- 9 to 20 cm. Prominently mottled pale olive (5Y 6/3), dark yellowish brown (10YR 3/4), gray (5Y 5/1) and strong brown (7.5YR 5/8) very fine sandy loam; crushed color olive gray (5Y 5/8); weak fine platy structure; pores as above; mica as above; common fine roots; abrupt smooth boundary; pH 8.0.

C1g -- 20 to 33 cm. Mottled greenish gray (10GY 5/1), dark gray (5Y 4/1), dark reddish brown (2.5YR 2/4), black (10YR 2/1), olive (5Y 5/3) and reddish brown (5YR 4/4) silt loam; crushed color dark grayish brown (10YR 4/2); weak fine platy structure; slightly sticky and nonplastic; mica as above; abrupt smooth boundary; pH 8.0.

C2g -- 33 to 53 cm. Mottled olive gray (5Y 4/2), very dark brown (10YR 2/2) and brown to da.k brown (10YR 4/3) very fine sandy loam; weak medium platy structure; crushed color dark grayish brown (10YR 4/2); few coarse Mn concretions; nonsticky and nonplastic; mica as above; abrupt smooth boundary; pH 8.5.

C3g -- 53 to 85 cm. Greenish gray (10GY 5/1) silt loam; weak medium platy structure; few coarse soft Mn concretions; pH 9.0.

C4g -- 85 to 150 cm. Dark greenish gray (10GY 4/1) silty clay loam; pH 9.0.

Type Location: Gimje Gun Jeollabug Do, about 100 meters from the Yellow Sea, Eunpa Ri, (Hagdong Burag) Gwanghwal Myeon.

Range in Characteristics: Depth over hardrock is probably more than 5 meters. Reaction is mildly to moderately alkaline. Apg horizons are 10 to 20 cm. thick, gray, dark gray, very dark gray or very dark grayish brown silt loam, loam or very fine sandy loam with many or common yellowish brown, strong brown or brown to dark brown mottles and common fine mica. The upper Cg layers are dominantly greenish gray or mottled greenish gray, dark gray, gray and olive gray silt loam, loam, silt or very fine sandy loam stratified and with platy structure of the original layer deposition. Crushed color hues are 2.5Y or less. The lower Cg layers beginning between 50 and 100 cm. below the surface and extending below 150 cm. are stratified greenish gray or dark greenish gray, very fine sandy loam, loam, silty clay loam, silt or silt loam with few or no mottles. Few to common fine mica flakes occur throughout the profiles.

Competing Series and Their Differentiae: The Mangyeong, Buyong and Jeonbug series are less saline, more mottled and better drained. The Buyong and Jeonbug soils have finer textures than the Gwanghwal series.

Setting: Local depressions adjacent to drainage ways in recently reclaimed nearly level tidal flats adjacent to the sea on the coastal plains. Slopes are less than 1 percent.

Principal Associated Soils: The Mangyeong and Jeonbug soils are associated with the Gwanghwal soils in slightly higher positions in the coastal plains.

Drainage and Permeability: Very poorly drained. Runoff is ponded or very slow. The watertable is in or near the surface except when artificially controlled. Permeability is moderately slow.

Use and Vegetation: These areas are used for flood irrigated rice and salt farms where sea water is evaporated. A few of the better drained areas are used for nonirrigated barley during dry seasons.

Distribution and Extent: These soils occur in the southern and western coastal plains in rather small scattered areas.

Series Established: Eunpa Ri, Gwanghwal Myeon, Gimje Gun, Jeollabug Do.

Remarks: The typifying pedon appears to come from an area used as a salt farm before conversion to rice paddy.

Lab. Nos. Dm207-212 Typifying Pedon

Depth cm	Horizon	Gravel 2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS >2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 9	Ap1g	0.0		0.4		3.9	35.9	53.9	5.9	SiL	0.6	80.5	13.0	FSL
9- 20	Ap2g	0.0		0.3		1.2	56.3	38.6	3.6	VFSL	0.5	85.9	10.0	LFS
20- 33	C1g	0.0		0.1		0.7	17.0	69.6	12.6	SiL	0.2	66.4	20.8	FSL
33- 53	C2g	0.0		0.1		1.8	43.9	47.6	6.6	VFSL	0.2	81.1	12.1	FSL
53- 85	C3g	0.0		0.1		0.9	27.0	61.5	10.5	SiL	0.2	71.5	17.8	FSL
85-150	C4g	0.0		0.1		1.4	40.2	52.2	6.1	SiL	0.2	81.7	12.0	FSL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	EC mmhos/cm 25°C	Moist. at Sat. %	pH H_2O (1:1)	pH 1 N KCl	O.M. %
35.8	18.4	5.6	-	38.7	30.6	7.4	6.4	0.50
36.2	12.8	4.4	1.46	-	-	8.1	7.0	0.30
36.8	25.4	8.8	1.34	31.5	32.9	8.0	7.0	0.50
36.3	15.4	7.4	1.34	-	-	7.7	7.0	0.20
36.1	19.6	6.6	-	41.0	29.9	7.6	6.9	0.50
36.1	14.2	5.3	-	31.5	32.1	7.8	7.0	0.20

CEC 2/	Extractable Cations Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
me/100g							
8.00	1.50	7.70	5.40	1.36	0.05	199.5	99.7
7.40	0.90	5.10	3.60	1.16	0.05	145.4	99.5
10.00	1.00	6.50	5.10	1.72	0.05	143.2	99.7
7.80	0.80	5.80	5.00	1.46	0.05	167.4	99.6
8.20	2.70	4.60	6.00	2.12	0.05	188.0	99.7
7.40	1.70	5.30	5.30	2.00	0.05	193.2	99.7

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UHT, JFD
29 October, 1969

GWANGJU SERIES

The Gwangju series is a member of the fine clayey, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have moderately deep silty mantles with brown silty clay loam Ap or Al horizons and yellowish red silty clay Bt horizons overlying very deep fine clayey moderately developed yellowish red to red silty clay Bbt horizons formed in old alluvial materials. They occur on very gently sloping uneroded remnants of strongly dissected old river terraces.

Typifying Pedon: Gwangju clay loam - reforested area (Field description Ulju Gun profile No. 14; colors are for moist soil.)

A11 -- 0 to 5 cm. Light yellowish brown (10YR 6/4) dry, brown to dark brown (7.5YR 4/4) loam to light clay loam; moderate very fine and fine granular structure; very friable, slightly sticky and slightly plastic; many fine and medium living grass, shrub and pine tree roots; clear smooth boundary; pH 4.5.

A12 -- 5 to 15 cm. Brown to dark brown (7.5YR 4/4) clay loam; weak fine and medium subangular blocky structure breaking readily to moderate fine granular; friable, sticky and plastic; common very fine discontinuous random inped simple intrestitial pores; roots as above; clear smooth boundary; pH 4.5.

B21t -- 15 to 55 cm. Yellowish red (5YR 4/6) clay; moderate fine and medium subangular blocky structure; common very fine and fine discontinuous random inped and few exped simple tubular pores; patchy thin clay cutans; slightly firm, sticky and plastic; few medium living roots; gradual wavy boundary; pH 5.0.

B22t -- 55 to 69 cm. Yellowish red (5YR 4/8) clay; moderate coarse medium and fine subangular blocky structure; common very fine pores as above; clay cutans as above; few thin discontinuous black, probably Mn, films on aggregate faces; slightly firm, sticky and plastic; gradual wavy boundary; pH 5.0.

B23b -- 69 to 115 cm. Yellowish red (5YR 4/6) clay; crushed color yellowish red (5YR 4/8); strong coarse medium and fine angular and some subangular blocky structure; very few very fine discontinuous random inped simple tubular pores; continuous thin clay cutans; and many thin discontinuous black films as above; firm, very sticky and very plastic; very few very fine living roots; gradual wavy boundary; pH 5.0.

B24b -- 115 to 170 cm. Red (2.5YR 4/8) clay; crushed color yellowish red (5YR 5/6); moderate very coarse prismatic structure breaking to angular and some subangular blocky; pores as above; continuous thin strong brown (7.5YR 5/8) clay cutans on vertical prism faces and dominantly continuous thin yellowish red clay cutans on blocky structural faces; many medium black, probably Mn, films; very firm, very sticky and very plastic; no roots; gradual wavy boundary; pH 4.5.

B3b -- 170 to 200 cm. Brownish yellow (10YR 6/6) clay; crushed color strong brown (10YR 5/8); moderate coarse platy structure; pores as above; common distinct yellowish-red (5YR 5/8) continuous clay cutans and few distinct very dark grayish brown, probably Mn, mottles on structural faces; firm, very sticky and very plastic; no roots; pH 4.5.

Type Location: Ulju Gun, Gyeongsangnam Do, Gyodong Ri, Samnam Myeon, approximately 3 km. south Unyang 400 meters east Unyang-Pusan road.

Range in Characteristics: Thickness of the upper sequum averages about 50 to 70 cm. and ranges from about 40 to 100 centimeters; however, the combined sola may range in depth to 200 cm. or more. These soils are strongly to medium acid throughout. Base saturation ranges considerably but is mostly less than 35 percent. Some mica occurs. The Al or Ap horizon, generally less than 20 cm. thick, may be brown to dark brown, yellowish brown or strong brown, particularly where cultivated or eroded, loam, silty clay loam or clay loam. A2 horizons are generally absent or only weakly expressed even in the least disturbed profiles. Bt horizons are moderately deep yellowish red or strong brown silty clay or silty clay loam. The Btb horizons are very deep yellowish red, red or dark red heavy silty clay loam, silty clay, heavy clay loam or light clay with moderate or strong structure. Sand particle sizes increase in the Bbt or Bb. The C horizons are dominantly stratified yellowish red, strong brown, yellowish brown and some gray very deep old alluvium with silty clay loam to clay textures, commonly with slightly weathered gravel and cobbles. The underlying residuum is commonly strongly and deeply weathered granitic saprolite though shale or other rocks may occur.

Competing Series and Their Differentiae: The competing series are the Banggi, Wangsan, Bancheon, Changpyeong, Hwadong, Gwangsan, Jingog and Jeonnam soils. The Banggi soils have clayey skeletal textures and lack silty mantles, the Wangsan soils have dark colored A horizons which are high in organic matter. The Bancheon and Changpyeong series do not have silty mantles. The Hwadong soils have no silty mantles, are moderately well drained have gray and yellowish brown mottles in the lower Bt and they occur on terraces at lower elevations. The Gwangsan and Jeonnam series lack silty mantles and are derived from residual granitic materials. The Jingog soils have yellower colors and Bbt and C horizons which are derived from residual granitic materials.

Setting: The Gwangju series is on gently and very gently sloping moderately and strongly dissected old high alluvial terrace remnants in valley and pediplane landscapes. Slopes are generally less than 7 percent with an extreme range of 15 percent usually adjacent to narrow valleys and escarpments. The regolith is mainly pleistocene continental deposits, normally stratified with fine textures, with gravel and cobbles in the base of the deposit and resting on extremely and deeply weathered residual granitic saprolite.

Principal Associated Soils: The well drained Dalcheon, Songjeong and Gwangsan series are associated on rolling and hilly residual uplands. In old alluvial and fan terrace landscapes, the Bancheon and on slightly lower elevations the moderately well drained Hwadong series may be associated. Several series such as the Baegsan, Bansan and Jisan may be associated in local valley alluvium.

Drainage and Permeability: Well drained. Runoff is medium. Permeability is very slow.

Use and Vegetation: Most areas are under upland cultivation with barley during winter and spring seasons and soybean, sweet potato, sesame, upland rice, bean, radish, cabbage, corn and pepper during summer and autumn seasons. Less extensive crops are melon, millet, grass, tobacco, wheat, castor bean and rye. Mulberry and fruit including apple, pear, peach and persimmon are frequently grown. Principal vegetation of the occasional uncultivated areas includes planted and wild pine with wild grass understory.

Distribution and Extent: Small areas occur on river terrace throughout the country. Exceptionally large areas are known to be in the vicinity of Gwangju City.

Series Established: Gwangsan Gun, Jeollanam Do, Iham Ri, Bia Myeon, 1965.

Remarks: The mantle materials are considered by some observers to have characteristics of loess while others consider local alluvium to be a more probable origin.

Lab. Nos. U107-113 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 5	A11	0.2	0.3	0.7	1.4	2.2	1.4	60.2	33.8	SiCL	2.9	13.9	49.4	SiC
5- 15	A12	0.6	0.3	0.7	1.6	2.4	1.5	57.9	35.6	SiCL	3.1	14.0	47.3	SiC
15- 55	B21t	0.0	0.1	0.3	1.1	1.3	0.7	53.0	43.5	SiC	1.8	9.3	45.4	SiC
55- 69	B22t	0.0	0.2	0.6	1.3	1.5	0.9	43.7	51.8	SiC	2.5	10.5	35.2	HC
69-115	B23b	0.0	0.2	0.7	1.6	1.6	0.7	46.5	48.7	SiC	2.9	7.9	40.5	HC
115-170	B24b	0.0	0.3	1.2	2.1	1.8	1.0	50.9	42.7	SiC	4.1	11.4	41.8	LiC
170-200	B3b	0.2	0.2	1.3	2.5	2.5	1.4	54.7	37.4	SiCL	4.6	12.8	45.2	SiC

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	S.G.	Atterberg Limits % LL	PI	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations (me/100g) Ca	Mg	Na	K	H
	37.3	19.6	-	2.63	52.0	20.1	4.8	3.7	4.70	16.90	0.40	0.60	0.03	0.29	-
	34.9	18.7	1.03	2.66	50.3	19.2	4.8	3.6	3.60	16.60	0.05	0.15	0.03	0.16	-
	26.6	19.1	1.22	2.75	49.6	23.4	5.0	3.6	0.90	13.10	0.00	0.25	0.04	0.09	-
	27.2	20.4	-	2.78	52.3	24.5	5.2	3.6	0.50	12.60	0.00	0.45	0.13	0.10	-
	29.7	20.6	1.21	2.77	50.3	19.4	5.4	3.6	0.40	7.30	0.20	0.65	0.03	0.12	-
	28.9	19.7	-	2.78	50.4	20.9	5.3	3.7	0.30	9.50	0.20	0.50	0.09	0.12	-
	28.4	17.4	-	2.77	45.8	19.7	5.6	3.9	0.30	10.10	0.05	0.55	0.09	0.12	-

Base Saturation % CEC	Sum of Cations	Elemental Analysis of Clay SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %
7.8	-	2.08	50.46	12.32	33.41
2.3	-	2.02	49.65	12.48	33.87
2.9	-	1.87	49.00	12.44	36.63
5.4	-	1.88	49.35	12.34	36.61
13.7	-	1.88	49.03	12.81	36.16
9.6	-	1.87	48.76	13.15	35.78
8.0	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KPJ, JFD
16 October, 1969

GWANGSAN SERIES

The Gwangsan series is a member of the fine clayey, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have thin brown to dark brown silty clay loam A horizons and very deep dark red to red clay to silty clay Bt horizons. They are developed in very deeply weathered residual materials over granite and granite gneiss on rolling relief, mainly in areas of strongly dissected old pediplanes.

Typifying Pedon: Gwangsan silty clay loam, eroded - pine forest (Field description Gwangsan Gun profile No. 112; colors are for moist soil.)

A -- 0 to 10 cm. Brown to dark brown (7.5YR 4/4) silty clay loam; moderate fine to medium granular structure; friable, slightly sticky and plastic; few quartz grit; few fine white mica; many fine roots; clear smooth boundary.

B1t -- 10 to 22 cm. Yellowish red (5YR 4/8) silty clay loam; moderate fine and medium subangular blocky structure; firm, sticky and plastic; few thin clay cutans; few very fine random pores; quartz grit as above; mica as above; common fine grass roots; clear wavy boundary.

B21t -- 22 to 54 cm. Dark red (10R 3/6-2.5YR 3/6) clay; strong fine to medium subangular blocky structure; moderately thick continuous clay cutans; very firm, very sticky and very plastic; few fine discontinuous random and oblique interstitial pores; few fine grass roots; quartz grit as above; mica as above; clear wavy boundary.

B22t -- 54 to 93 cm. Red (2.5YR 4/6) clay; strong medium to coarse subangular blocky structure; firm, sticky and plastic; continuous moderately thick clay cutans; few fine discontinuous random oblique interstitial pores; about 3 percent quartz grit; common fine white mica; very fine grass roots; clear wavy boundary.

B23t -- 93 to 150 cm. Red (10YR 4/8) clay; moderate fine to medium subangular blocky structure; firm, sticky and plastic; broken moderately thick dark red (2.5YR 3/6) clay cutans; few fine angular vein quartz gravel in strongly weathered granite; many fine yellow and white mica.

Type Location: Gwangsan Gun, Jeollanam Do, approximately 200 meters west Songjeong Eub, in Pyeongdong Myeon, Maehwa Ri, on right side of the road leading to Samdo Myeon.

Range in Characteristics: The solum ranges from 150 to 200 cm. in thickness and the saprolite is strongly and very deeply weathered, ranging to more than 10 meters in thickness. Hard bedrock has not been observed in areas of the Gwangsan series. Quartz grit is usually less than 5 percent in the solum but commonly increases with depth. Few to common mica occur throughout the profile. Reaction is very strongly to strongly acid throughout. Base saturation is generally less than 35 percent throughout the control section. The A horizons are brown to dark brown and occasionally strong brown silty clay loam or clay loam. The Bt horizons are dark red to red clay or silty clay with strongly developed subangular blocky structure and continuous dark red clay cutans. The C horizons are yellowish brown or strong brown mainly silt loam, loam, silty clay loam or sandy loam, moderately to strongly weathered granitic saprolite.

Competing Series and Their Differentiae: These are the Gwangju, Jeonnam, Dalcheon, Sirye, Cheongog, Jingog, Bonggye and Bansan soils. The Gwangju soils have a fine silty mantle over a Btb developed in old alluvial materials and less strongly developed structure. The Jeonnam soilshave moderately developed subsoil structure and somewhat less red colors. The Dalcheon soils are moderately deep over saprolite and less red. The Sirye soils, developed on shale materials, have less red Bt horizons and relatively thin grayish brown shale saprolite. The Cheongog soils contain less quartz grit, no mica, color values less than 4 throughout and are derived from dark colored basic crystalline materials. The Jingog soils have fine silty mantles over yellowish brown clayey Btb horizons and are derived from residual granitic materials. The Bonggye soils are somewhat less red and are free of mica. The Bansan soils have dark colored A horizons.

Setting: The Gwangsan series is developed in residuum on undulating to sloping low rolling hills underlaid by deeply and strongly weathered granite saprolite mostly in areas of dissected old pediplanes. Slopes range from 2 to 30 percent but are mostly 2 to 7 percent.

Principal Associated Soils: The Jeonnam, Gingog and Seongjeong soils are associated in similar landscape positions. The Jisan, Bansan and Baegsan soils are associated in local valley and footslope positions.

Drainage and Permeability: The Gwangsan soils are well drained and very slowly permeable. Runoff is moderate or rapid depending on the slope.

Use and Vegetation: Most of these soils are cultivated for upland crops such as barley, wheat, corn, millet, potato, radish and sweet potato. The rest is mainly in pine forest.

Distribution and Extent: These soils are of limited extent and occur chiefly in the southern part of the country.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Lab. Nos. K276-280 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	A	5.3	3.2	4.5	3.3	2.7	1.2	52.6	32.5	SiCL	11.8	16.6	39.1	LiC
10- 22	B1t	6.6	3.2	5.0	3.3	2.3	1.1	45.9	39.2	SiCL	12.2	15.5	33.1	LiC
22- 54	B21t	0.4	5.1	4.3	2.7	2.1	1.1	28.7	56.0	C	12.7	8.4	22.9	HC
54- 93	B22t	3.0	3.8	6.3	4.0	4.5	3.2	29.1	49.1	C	15.1	10.5	25.3	HC
93-150	B23t	8.6	2.4	6.4	5.5	8.6	5.9	26.8	44.4	C	16.3	18.5	20.8	LiC

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
								me/100g						
	29.6	12.7	4.9	3.6	2.70	12	7.16	0.30	0.00	0.12	0.14	-	7.8	-
	28.8	14.4	5.1	3.7	0.80	2	6.98	0.30	0.00	0.18	0.12	-	8.6	-
	30.1	20.4	5.1	3.6	0.38	-	8.76	0.70	0.00	0.24	0.12	-	12.0	-
	36.2	19.8	5.1	3.5	0.28	-	8.22	0.70	0.00	0.36	0.12	-	14.3	-
	37.9	20.8	5.1	3.5	0.17	-	8.46	1.00	0.00	0.28	0.14	-	16.7	-

Elemental Analysis of Clay							3/
H_2O %	Igni loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	CEC me/100g
4.38	10.37	2.12	45.83	9.28	30.86	2.32	37.53
-	-	-	-	-	-	-	-
4.78	10.54	1.99	44.17	10.30	31.05	2.10	38.78
-	-	-	-	-	-	-	-
3.57	9.58	1.70	41.33	11.68	33.90	2.07	38.78

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, NaCl Extracted

Established Series
UKT, JFD
22 October, 1969

GYUAM SERIES

The Gyuam series is a member of the coarse silty, mixed, nonacid, mesic family of Aquic Fluventic Eutrochrepts (Alluvial soils). These soils have moderately thick grayish brown silt loam Apg horizons in paddy and moderately deep brown silt loam cambic B horizons. Cg horizons below 50 to 100 cm. are mottled gray and brown and have coarse-silty textures. This series is developed in silty materials on broad continental alluvial plains.

Typifying Pedon: Gyuam silt loam - barley rotated with flood irrigated rice (Field description Gimhae Gun profile No. 112; colors are for moist soil.)

Ap1g -- 0 to 13 cm. Dark grayish brown (10YR 4/2) silt loam; common fine to medium prominent yellowish red (5YR 5/6) exped mottles; puddled structure breaking readily to weak coarse blocky and medium and fine granular; friable, slightly sticky and slightly plastic; common fine dead rice roots; few fine yellow mica; hardness 15.0; abrupt smooth boundary; pH 5.8.

Ap2 -- 13 to 32 cm. Yellowish brown (10YR 5/4) heavy fine sandy loam; common fine distinct brown to dark brown (7.5YR 4/4) and dark brown (7.5YR 3/2) Mn mottles; common thin continuous vertical grayish brown (10YR 5/2) mottles extending from above; crushed color dark yellowish brown (10YR 4/4); weak coarse prismatic structure breaking to weak coarse platy; firm, slightly sticky and slightly plastic; common fine simple tubular vertical pores and rice root channels; hardness 20.0; clear slightly wavy boundary; pH 6.5.

B1 -- 32 to 53 cm. Brown (10YR 5/3) silt loam; common coarse faint brown to dark brown (10YR 4/3) mottles; crushed color brown (10YR 5/3); weak coarse prismatic structure breaking readily to weak medium subangular blocky and moderate fine granular; common continuous moderately thick grayish brown (10YR 5/2) exprism mottles and films from above decreasing with depth; friable, slightly sticky and slightly plastic; pores as above; few medium irregular worm holes and worm casts; mica as above; hardness 18.0; clear smooth boundary; pH 6.5.

B2g -- 53 to 110 cm. Grayish brown (10YR 5/2) silt loam; many medium faint brown to dark brown (10YR 4/3) mottles; weak coarse prismatic structure breaking readily to weak coarse subangular and moderate coarse and fine granular; broken thin grayish brown exprism films; crushed color brown (10YR 5/3); friable, slightly sticky and slightly plastic; pores as above; mica as above; hardness 15.0; clear smooth boundary; pH 6.8.

C1g -- 110 to 150 cm. Mottled gray (10YR 5/1) and brown to dark brown (10YR 4/3) silt loam; crushed color brown to dark brown (10YR 4/3); many fine yellow mica; slightly wet, slightly sticky and slightly plastic; clear smooth boundary.

C2g -- 150 to 170 cm. Dark gray (5Y 4/1) silt loam; common fine distinct olive (2.5Y 5/3) and fine to medium prominent yellowish red (5YR 5/8) mottles; saturated; granular structure.

Type Location: Gimhae Gun, Gyeongsangnam Do, approximately 150 meters south Daejin Gyo village, Jinyeon Eup.

Range in Characteristics: Depth to hard rock is probably more than 5 meters below the surface. Base saturation is more than 60 percent. Reaction is slightly to medium acid and is usually highest in the transition with fluvio-marine plains and in areas where the source materials are derived from soils of sedimentary geology. The Apg horizons are moderately thick grayish brown, dark grayish brown or gray silt loam, loam or light silty clay loam in paddy with various brown mottles. The cambic B horizons, with weak prismatic and blocky structure, are brown, dark yellowish brown, yellowish brown, brownish yellow or dark brown friable silt loam or loam with gleyed gray fluctuating watertable induced mottles between 50 and 100 cm. and increasing with depth. Cg horizons below 50 to 100 cm. are mottled gray and brown weakly stratified rather homogeneous silt loam or loam with no soil structure. The fluctuating watertable and accompanying gray mottles commonly occur at about 70 cm. below the surface except where artificially controlled.

Competing Series and Their Differentiae: These are the Ihyeon, Jungdong, Nagdong, Bonryang and Tongcheon series. The Ihyeon soils are free of gray mottles above 100 cm. depth except in paddy. The Jungdong, Nagdong, and Bonryang soils have coarser textures and lack gray watertable mottles above 100 cm. depths except in paddy. The Tongcheon soils have loamy skeletal textures.

Setting: The Gyuam soils occur on nearly level broad continental recent alluvial plains derived chiefly from granitic and related soil materials. Slopes are less than 2 percent averaging about 1 percent.

Principal Associated Soils: The Ihyeon, Honam, Nagdong, Jeonbug and Jungdong soils are associated. The Honam and Jeonbug soils have grayer colors throughout.

Drainage and Permeability: Moderately well drained. Permeability is moderately slow and runoff is slow.

Use and Vegetation: Most areas are used for flood irrigated rice and nonirrigated barley. Areas near villages and towns may be used for vegetables such as cabbage, onion, leek, lettuce, melon, tomato, spinach, red pepper and Chinese cabbage.

Distribution and Extent: The Gyuam soils are of moderate extent and are distributed in the larger alluvial plains throughout the country.

Series Established: Puyeo Gun, Chungcheongbug Do, 1967.

Remarks: The Typifying Pedon is in Puyeo Gun where fluvio marine alluvium underlies continental alluvium below 2 or 3 meters. This may account at least in part for the base saturation, pH and Ca increases with depth.

Lab. Nos. G1162-165 **Typifying Pedon**

			Particle Size Distribution 1/ (mm) %												
			U. S. Department of Agriculture								International				
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 13	Ap1g	0.0	1.1			2.8	20.9	54.1	21.1	SiL	1.5	31.0	46.4	SiCL
13- 32	Ap2	0.0	0.4			0.5	21.8	58.9	18.4	SiL	0.6	40.6	40.4	CL
32- 53	B1	0.0	0.4			2.1	10.6	67.9	19.0	SiL	0.6	35.2	45.2	SiCL
53-110	B2g	0.0	0.4			0.4	14.3	69.1	15.8	SiL	0.6	41.4	42.2	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations Ca me/100g	Mg	Na	K	H
51.5	44.4	12.7	1.16	5.4	3.9	2.32	86	12.20	4.60	1.40	0.27	0.20	1.11
43.2	35.0	11.3	1.35	6.0	4.2	1.27	11	12.00	6.60	2.45	0.30	0.12	0.25
42.6	36.4	11.7	1.34	6.3	4.4	1.16	8	12.85	8.55	3.00	0.30	0.12	0.10
42.4	36.0	11.1	-	6.7	4.6	0.53	11	13.80	9.50	3.15	0.25	0.15	0.05

Base Saturation % CEC	Sum of Cations
53.0	85.4
78.9	97.4
93.2	99.2
99.8	99.6

1/ Pipette method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
29 October, 1969

HABIN SERIES

The Habin soils are member of the coarse loamy, mixed, mesic family of Lithic Eutrochrepts (Lithosols). These soils have thin dark reddish brown channery loam A horizons and thin reddish brown channery loam cambic B horizons over unweathered bedrock. They are developed on hilly to mountainous relief and are derived from interbedded reddish brown shale, sandstone and conglomerate materials.

Typifying Pedon: Habin rocky loam - pine forest (Field description Dalseong Gun profile No. 41; colors are for moist soil.)

A -- 0 to 14 cm. Reddish brown (5YR 4/4) channery loam; moderate very fine to fine granular structure; friable, slightly sticky and slightly plastic; many fine to medium living grass roots; the land surface is about 10 percent bedrock outcrops; clear smooth boundary; pH 6.2.

B -- 14 to 39 cm. Reddish brown (5YR 4/3) channery silt loam; weak fine to medium subangular blocky structure; friable, slightly sticky and slightly plastic; common fine living grass and pine tree roots; clear smooth boundary; pH 6.5.

C -- 39 to 45 cm. Slightly weathered reddish brown shale.

R -- 45 cm. Hard consolidated interbedded reddish brown shale and fine textured sandstone.

Type Location: Dalseong Gun, Gyeongsangbug Do, Dodong 2 Gu, Guji Myeon.

Range in Characteristics: Thickness of A horizons range from 10 to 20 cm. and depth to hard rock is within 50 cm. of the surface. Reaction ranges from medium to slightly acid. Base saturation is commonly more than 60 percent. 8 to 35 percent shaley and channery fragments commonly occur. Bedrock outcrops may be up to 90 percent. A horizons are dark reddish brown, reddish brown, weak red or dusky red channery loam, fine sandy loam or silt loam. Cambic B horizons are 15 to 30 cm. thick, reddish brown, weak red, dusky red or dark reddish brown channery silt loam or loam. C horizons are thin weathered reddish brown very channery loam, silt loam or fine sandy weathered residual bedrock.

Competing Series and Their Differentiae: Related soils are in the Buyeo, Daegu, Mudeung and Jeongja series. The Buyeo soils are similar except for having moderately deep argillic Bt horizons. The Daegu soils have loamy skeletal textures, less red colors and grayish brown shale parent materials. The Mudeung soils have fine loamy textures, yellowish brown colors and are derived from porphyry materials. The Jeongja soils have fine loamy textures and are derived from dark colored basic crystalline materials.

Setting: Habin soils occur on gently sloping to steep mountainous areas and are derived from reddish brown shale, sandstone and conglomerate materials. Slopes range from 15 to 60 percent but dominant slopes are 30 to 60 percent.

Principal Associated Soils: The Buyeo, Daegu, Sirye and Samam soils are associated. The Buyeo soils are associated on smoother relief. The Daegu and Sirye soils occur on associated grayish brown shale areas. The Samam soils occur in local valley alluvium below the Habin and Buyeo soils.

Drainage and Permeability: Somewhat excessively drained and permeability is probably moderate or moderately rapid. Runoff is probably rapid to very rapid after solum saturation.

Use and Vegetation: Most areas are used for fuelwood forest including pine trees, oak, alder and acacia. Azalea and wild grass understory occurs. Some areas are used for upland crops such as barley, pepper, soybean, melon and cotton.

Distribution and Extent: The Habin soils are of relatively small extent and are distributed in the southeastern and western parts of the country.

Series Established: Dalseong Gun, Gyeongsangbug Do, 1967.

Habin Series Contd.

Lab. Nos. T51-52 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0-14	A	12.4	2.6	6.9	12.5	16.4	8.5	44.2	8.9	L	29.8	39.4	25.9	SL
14-39	B	3.9	1.1	4.1	8.1	15.1	9.4	50.5	11.7	SiL	16.7	38.2	33.4	L

Moisture Retention %			Atterberg Limits %		pH		O.M.	Avail.	2/	Extractable Cations				
1/10 atms	1/3 atms	15 atms	LL	PI	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H
									me/100g					
	18.8	5.3	NP		5.5	3.8	0.90	6	5.40	0.10	0.11	2.05	0.85	57.6
	22.1	7.0	26	4	5.6	3.8	0.30	6	8.80	3.20	2.80	0.40	0.10	0.70

Base Saturation %		Elemental Analysis of Clay						3/
CEC	Sum of Cations	H_2O %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	CEC me/100g
57.6	84.3	-	-	-	-	-	-	-
73.6	90.3	5.0	2.6	50.5	8.5	28.0	2.1	25.4

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, NaCl Extracted

Established Series
UKT, KPJ, JFD
4 November, 1969

HAECHEOG SERIES

The Haecheog series is a member of the fine silty, mixed, acid, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have thin dark gray silty clay loam Apg horizons and moderately thick gray silty clay loam cambic Bg horizons with many prominent yellowish iron sulfate mottles and extremely acid reaction. Cg horizons are dark gray stratified silt loam with neutral field reaction and extremely acid dry soil reaction. These soils occur in slightly depressed positions on broad fluvio-marine plains.

Typifying Pedon: Haecheog silty clay loam - rice (Field description Gimhae Gun profile No. 15; colors are for moist soil.)

Ap1g -- 0 to 7 cm. Dark gray (10YR 4/1) silty clay loam; common fine to medium faint yellowish brown (10YR 5/6) mottles; puddled structure, breaking to weak fine and medium granular; friable, sticky and plastic; many fine dead rice roots; abrupt smooth boundary; pH 5.8.

Ap2g -- 7 to 15 cm. Grayish brown (2.5YR 5/2) silty clay loam; common fine to medium prominent strong brown (7.5YR 5/6), dark brown (7.5YR 4/4) and few yellow (2.5Y 8/6) mottles; weak coarse prismatic structure breaking to weak coarse platy and some blocky; firm, sticky and plastic; clear smooth boundary; pH 5.0.

Bg -- 15 to 40 cm. Gray (10YR 5/1) silty clay loam; many coarse prominent yellow (2.5Y 8/6) iron sulfate and coarse to medium distinct brown to dark brown (10YR 4/3) mottles along many semi-decomposed reed stems and roots; weak coarse prismatic structure; firm, very sticky and very plastic; abrupt wavy boundary; pH 4.5.

C1g -- 40 to 65 cm. Dark gray (2.5Y N4/) silt loam; few coarse distinct yellowish brown (10YR 5/6) mottles as above; structureless (massive); slightly sticky and slightly plastic; common medium to coarse semi-decomposed reed stems and roots; gradual smooth boundary; pH 4.8.

C2g -- 65 to 150 cm. Dark gray (2.5Y N4/) fine sandy loam strata; structureless (massive); slightly sticky and nonplastic; no mottles; no stems or roots; pH 8.0.

Type Location: Gimhae Gun, Gyeongsangnam Do, about 1 km. east of Haecheog Ri, Myeongji Myeon.

Range in Characteristics: Solum thickness ranges from 25 to 50 cm. and depth to hard rock is probably more than 5 meters. Many medium yellow iron sulfate oxidation mottles occur above 50 cm. Base saturation is more than 35 percent in the solum and more than 60 percent in the Cg horizons. Reaction is extremely acid throughout the solum except where limed and neutral or alkaline in the Cg horizons except when dried. Brackish water occurs in the Cg horizon beginning near 50 cm. depths except when artificially drained. The Apg horizons are 10 to 20 cm. thick, gray or grayish brown silty clay loam or silty clay with faint yellowish brown, strong brown or yellowish red mottles. The cambic Bg horizons range from 20 to 40 cm. thick, are grayish brown, gray, dark gray or dark grayish brown silty clay loam, silt loam or loam with many prominent yellow, strong brown or yellowish brown iron sulfate mottles and contain partly decomposed reed stems and roots. The Cg horizons are dark gray or very dark grayish brown stratified loam, silt loam or very fine sandy loam grading from 2.5Y to 5Y hues with increasing depth. Field reaction is neutral to moderately alkaline and dry soil reaction is very strongly to extremely acid.

Competing Series and Their Differentiae: These are the Bongrim, Deunggu, Gimhae and Hagseong series. The Bongrim soils have fine silty textures throughout. The Deunggu soils have more and more distinct mottles, have been reclaimed and farmed longer and are less poorly drained. The Gimhae soils have fine silty textures throughout, contain more distinct mottles and occupy slightly higher landscape positions with poor drainage. The Hagseong soils have fine silty over sandy textures.

Setting: The Haecheog soils occur on level and slight depressions in broad fluvio-marine plains. Slopes are less than 2 percent with less than 1 percent slopes dominating.

Principal Associated Soils: The Gimhae, Deunggu, Bongrim, and Sadu series are associated. The Sadu soils have sandy textures, browner colors, better drainage and occur on levees near the sea.

Drainage and Permeability: Very poorly drained. Permeability is moderately slow and runoff is very slow to ponded. The ground watertable is in or near the surface during most seasons except where artificially controlled. Artificial drainage and irrigation systems are generally not well developed.

Use and Vegetation: Most areas of these soils have only recently been reclaimed from tidal marsh with wild reed and grass vegetation. Reclaimed areas produce rather low yields of flood irrigated rice.

Distribution and Extent: The Haecheog soils are of small extent and occur in the southern part of the country on level broad fluvio-marine plains.

Series Established: Gimhae Gun, Gyeongsangnam Do, April 1968.

Remarks: The typifying pedon is finer in the upper horizons than usual for the series. The Haecheog series is one of the so called Acid Sulfate soils in Korea in which the substrata reaction decreases from about neutral to extremely acid on drying.

Lab. Nos. G172-76 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 7	Ap1g	0.0		1.2		2.5	1.1	53.5	41.7	SiC	1.5	8.2	48.6	SiC
7- 15	Ap2g	0.0		2.0		3.0	1.9	51.3	41.8	SiC	2.3	10.1	45.8	SiC
15- 40	Bg	0.0	0.4	0.9	1.1	3.9	2.2	52.5	39.0	SiCL	2.7	14.4	43.9	LiC
40- 65	C1g	0.0		1.5		1.5	20.9	61.2	14.9	SiL	1.8	53.1	30.2	L
65-150	C2g	0.0		6.6		43.5	6.5	32.4	11.0	FSL	10.7	59.5	18.8	SL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH: H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	Free Fe_2O_3 %	Mn ppm	2/ CEC	Extractable (me/100g): Ca	Mg	Na
61.6	46.5	29.2	1.14	4.8	4.0	3.71	51	1.34	-	12.9	2.70	6.30	1.90
56.2	45.6	33.9	1.14	4.4	3.5	2.24	29	1.61	0.0	14.5	1.55	3.60	1.70
54.7	43.8	32.5	0.94	3.8	3.1	2.00	10	2.49	0.0	13.6	1.05	3.05	1.00
39.3	29.0	14.2	-	4.2	3.5	1.24	3	0.97	-	9.7	3.00	9.25	2.83
[illegible]2.8	20.9	9.0	-	3.5	2.9	0.95	37	1.74	-	6.7	1.90	4.80	2.10

Cations: K	H	Base Saturation %: CEC	Sum of Cations	Elemental Analysis of Clay: Igni-Loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	3/ CEC me/100g
1.05	1.24	92.6	90.6	10.26	2.43	48.53	6.93	29.53	1.35	33.0
0.83	4.85	53.0	61.3	-	-	-	-	-	-	-
0.75	8.28	43.0	41.4	10.99	2.62	49.00	7.55	27.06	1.73	31.5
1.15	3.57	167.3	82.0	-	-	-	-	-	-	-
0.02	4.85	116.7	64.[illegible]	-	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N-$CaCl_2$ Saturated, NaCl Extracted

Established Series
UKT, JFD
29 October, 1969

HAGSAN SERIES

The Hagsan series is a member of the fine loamy over sandy, mixed, mesic family of Aquic Fluventic Eutrochrepts (Alluvial soils). These soils have moderately thick grayish brown loam Apg horizons in rice paddy and moderately deep yellowish brown clay loam cambic B horizons with gray mottles. The C horizons are mottled pale brown and gray loamy sand with few pebbles. They occur on nearly level to gently sloping alluvial plains and alluvial slopes and are formed in stratified continental alluvial materials.

Typifying Pedon: Hagsan loam - paddy rice (Field description Damyang Gun profile No. 19; colors are for moist soil.)

Ap1g -- 0 to 12 cm. Dark gray (5Y 4/1) loam; puddled, structureless (massive); friable, slightly sticky and slightly plastic; common fine rice roots; clear smooth boundary; pH 5.8.

Ap2g -- 12 to 18 cm. Gray (5Y 5/1) silt loam; common fine distinct dark grayish brown (10YR 4/2) mottles; weak medium to fine platy and subangular blocky structure; friable, slightly sticky and slightly plastic; few fine rice roots; common fine oblique inped tubular pores; abrupt smooth boundary; pH 5.6.

B2 -- 18 to 25 cm. Yellowish brown (10YR 5/8) silty clay loam; common fine distinct red (2.5YR 4/8) and few fine distinct olive gray (5Y 5/2) mottles; crushed color yellowish brown to dark yellowish brown (10YR 5/6-4/4); weak coarse prismatic structure breaking to weak fine and medium subangular blocky; firm, slightly sticky and plastic; few fine rice roots; common fine oblique inped tubular pores; clear smooth boundary; pH 5.8.

B3 -- 25 to 57 cm. Dark yellowish brown (10YR 4/4) sandy clay loam; weak coarse prismatic breaking to weak medium and coarse subangular blocky structure; firm, sticky and plastic; thin continuous dark gray (10YR 4/1) clay cutans; very few fine rice roots; few fine inped tubular vertical pores; clear smooth boundary; pH 6.4.

C -- 57 to 103 cm. Pale brown (10YR 6/3) loamy sand; structureless (single grain); few fine faint brown to dark brown (10YR 4/3) and gray (10YR 4/1) mottles; friable, nonsticky and nonplastic; pH 6.3.

Type Location: Damyang Gun, Jeollanam Do, about 500 meters south of Seongsan Ri, Goseo Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is greater than 3 meters. Base saturation is more than 60 percent. Reaction is medium to slightly acid. Apg horizons are dark grayish brown, grayish brown, gray or olive gray silt loam, silty clay loam, light clay loam or fine sandy clay loam with mottles. The cambic B horizons are yellowish brown, dark yellowish brown, brown, brownish yellow, light yellowish brown or strong brown silty clay loam, clay loam or loam with grayish brown, dark grayish brown, gray or dark gray mottles. The C horizons are pale brown, brown or grayish brown loamy sand, loamy coarse sand or sand with mottles. Less than 35 percent gravel occurs.

Competing Series and Their Differentiae: These are the Tongcheon, Man seong, Yongji, Seoggye, Sachon and Hogye series. The Tongcheon soils have loamy-skeletal textures. The Man seong soils have grayer colors, imperfect drainage and fine loamy over sandy skeletal textures. The Yongji soils have fine loamy textures throughout and occur in narrow side valley local alluvium. The Seoggye and Sachon soils are in the coarse loamy textural family. The Hogye soils have loamy skeletal textures and lack gray groundwater mottles.

Setting: The Hagsan series occurs on level to nearly level alluvial plains, alluvial slopes and fan terraces and is formed in stratified alluvial materials. Dominant slopes are 1 to 2 percent and range from 0 to 4 percent.

Principal Associated Soils: In addition to competing series. The Bonryang, Jungdong, Hwabong and Hwangryong soils are associated. The Bonryang soils are better drained and have coarse loamy over sandy family textures. The Jungdong soils are well drained and have coarse loamy textures throughout the profiles. The sandy Hwabong soils are well drained. The Hwangryong soils are excessively drained and belong to the sandy skeletal texture family.

Drainage and Permeability: Moderately well drained. Permeability is moderate and runoff is slow.

Use and Vegetation: Most of these soils are used for flood irrigated paddy rice during wet summer and nonirrigated barley during dry winter and spring seasons. Some areas are used also for cabbage, cucumber, onion, water melon, chinese cabbage and similar upland crops.

Distribution and Extent: The Hagsan soils are of moderate extent and are distributed along the tributaries to main streams throughout the country.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Hagsan Series Contd.

Lab. Nos. Ee67-71 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 12	Ap1g	1.8	3.8	6.7	10.0	9.7	8.4	42.5	18.9	L	22.0	33.0	26.1	CL
12- 18	Ap2g	6.3	5.0	8.2	11.3	10.4	8.6	38.5	18.0	L	26.4	28.4	27.2	CL
18- 25	B2	1.2	2.0	4.3	7.8	8.7	7.5	38.3	30.4	CL	15.5	23.3	29.4	LiC
25- 57	B3	2.6	2.8	7.7	18.4	15.9	9.0	24.6	21.6	SCL	32.0	28.7	17.7	SCL
57-103	C	10.4	13.8	25.6	33.7	11.2	2.8	6.0	6.9	LCoS	76.3	12.1	4.7	LCoS

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	CEC 2/	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	37.4	13.8	5.8	4.1	2.38	7.00	1.85	0.57	0.42	0.20	0.85	43.4	80.0
	34.9	12.6	5.6	3.9	2.07	6.65	1.50	0.50	0.22	0.15	1.40	35.6	62.9
	34.5	17.2	5.8	4.2	0.97	7.10	2.32	0.95	0.20	0.12	0.50	50.6	87.8
	25.3	13.0	6.4	4.4	0.52	7.85	4.37	1.42	0.22	0.10	0.25	77.8	96.1
	10.4	4.4	6.5	4.5	0.83	3.20	1.40	0.45	0.50	0.10	0.10	76.6	96.1

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
30 October, 1969

HAGSEONG SERIES

The Hagseong series is a member of the fine silty over sandy mixed, nonacid, mesic family of fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick dark grayish brown silt loam Apg horizons and moderately deep dark gray to grayish brown silt loam to loam cambic Bg horizons. The Cg horizons are dark gray stratified loamy sand to sand. The Hagseong series is developed in alluvium on level fluvio-marine plains.

Typifying Pedon: Hagseong silt loam - rice (Field description Ulju Gun profile No. 65; colors are for moist soil.)

Ap1g -- 0 to 14 cm. Brown to dark brown (10YR 4/3) silt loam; common fine and medium prominent dark gray (5Y 4/1) and faint dark yellowish brown (10YR 4/4) mottles; crushed color dark grayish brown to grayish brown (2.5Y 4.5/2); weak medium and coarse granular structure; friable, sticky and plastic; few very fine and fine discontinuous random inped simple tubular pores; few very fine mica flakes; many fine and medium dead rice and wild grass roots; abrupt smooth boundary; pH 6.5.

Ap2g -- 14 to 25 cm. Very dark grayish brown (2.5Y 3/2) silt loam; few fine and medium distinct yellowish brown (10YR 5/4) mottles; crushed color as above; moderate fine to coarse platy and some subangular blocky structure; friable, sticky and plastic; few very fine and fine discontinuous vertical random pores; few very fine mica flakes; common fine and medium roots as above; clear smooth boundary; pH 8.0.

B2g -- 25 to 39 cm. Dark gray (5Y 4/1) silt loam; common fine and medium prominent dark yellowish brown (10YR 4/4) mottles; crushed color dark grayish brown (2.5Y 4/2); moderate coarse prismatic structure breaking to moderate fine to coarse subangular blocky; few dark gray clayey cutans on prisms; firm, sticky and plastic; common fine and medium discontinuous vertical random pores; few very fine mica flakes; few fine medium roots as above; clear smooth boundary; pH 8.0.

B31g -- 39 to 47 cm. Grayish brown (2.5Y 5/2) silt loam; many fine and medium prominent strong brown (7.5YR 5/6) inprism mottles; crushed color grayish brown to dark grayish brown (10YR 4.5/2); moderate coarse prismatic structure breaking to moderate fine to coarse subangular blocky; firm, slightly sticky and slightly plastic; thin patchy gray clayey cutans on prisms; common fine and medium discontinuous random vertical pores; few very fine mica flakes; few very fine and fine roots as above; clear smooth boundary; pH 8.2.

B32g -- 47 to 56 cm. Grayish brown (2.5Y 5/2) silt loam; few fine and medium distinct dark yellowish brown (10YR 4/4) inprism mottles; crushed color grayish brown (10YR 5/2); weak coarse prismatic structure breaking to moderate medium to coarse subangular blocky; firm, slightly sticky and slightly plastic; thin patchy gray clayey cutans on prisms; common fine and medium discontinuous vertical random pores; few very fine mica flakes; few fine dead rice roots; clear smooth boundary; pH 8.2.

C1g -- 56 to 68 cm. Grayish brown to dark grayish brown (2.5Y 4.5/2) loam; common fine and medium prominent yellowish brown (10YR 5/8) inped mottles; brown to dark brown (10YR 4/3) crushed color; nearly structureless breaking to weak coarse blocky; consistence as above; pores as above; mica as above; clear smooth boundary; pH 8.3.

C2g -- 68 to 95 cm. Very dark gray (5Y 3/1) silt loam; structureless (massive); firm, slightly sticky and slightly plastic; few fine and medium discontinuous vertical random pores; very few very fine mica; clear smooth boundary; pH 8.0.

C3g -- 95 to 120 cm. Dark olive gray (5Y 3/2) loamy sand; structureless (single grain); loose, nonsticky and nonplastic; very few very fine mica; pH 8.5.

Type Location: Ulsan City, Gyeongsangnam Do, 200 meters east of Myeongcheong village.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is probably more than 5 meters. Base saturation is more than 60 percent in the control section. Reaction is slightly acid in the surface and neutral to mildly alkaline in the Bg and Cg horizons. Few fine mica flakes occur throughout the profiles. Apg horizons are 20 to 30 cm. thick, grayish brown, dark grayish brown, very dark grayish brown or gray loam, silt loam or silty clay loam. Cambic Bg horizons are very dark gray, dark gray, gray, dark grayish brown or grayish brown silt loam, loam or light silty clay loam with few to common distinct and prominent yellowish brown, strong brown, dark yellowish brown or dark brown mottles. Cg horizons are usually dark olive gray, olive gray, very dark grayish brown, dark grayish brown or gray loamy sand or sand with a few pebbles. A few sea shells may occur.

Competing Series and Their Differentiae: These include Daldong, Jeonbug, Mangyeong, Hamchang Buyong, Bongrim, Haecheog and Gimhae soils. The Daldong soils have coarse loamy textures, more mottles and imperfect drainage. The Jeonbug soils have fine silty textures throughout, more mottles and more acid reaction. The Mangyeong soils have coarse silty textures. The Hamchang soils have coarse loamy textures, more acid reaction and are derived from continental alluvial materials. The Buyong soils have fine clayey textures. The Bongrim and Gimhae soils have fine silty textures and extremely acid solum reaction. The Haecheog soils have coarse loamy substrata, grayer colors and very poor drainage.

Setting: The Hagseong soils are formed in alluvium on level fluvio-marine plains with 0 to 1 percent slopes ranging to 2 percent.

Principal Associated Soils: The Daldong, Deogha and Buyong soils are associated in similar physiographic positions.

Drainage and Permeability: Poorly drained, moderately slow permeability and very slow runoff. The watertable is within 10 to 25 cm. of the surface during most seasons except where artificially controlled.

Use and Vegetation: The Hagseong soils are used for paddy rice only.

Distribution and Extent: The Hagseong soils are of small extent and are distributed mainly in the southern and western coastal areas.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966.

Lab. Nos. U364-371 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori- zon	Gra- vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex- tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 14	Ap1g	0.0		1.7		2.4	3.2	68.7	24.0	SiL	2.1	23.7	50.2	SiCL
14- 25	Ap2g	0.0		1.7		2.5	3.2	69.9	22.7	SiL	2.1	23.3	51.9	SiCL
25- 39	B2g	0.4		2.0		2.9	3.8	65.8	25.5	SiL	2.5	19.6	52.4	SiCL
39- 47	B31g	0.9		5.1		7.1	6.6	59.8	21.4	SiL	6.6	34.0	38.0	CL
47- 56	B32g	0.0		4.8		9.1	10.6	58.7	16.8	SiL	6.1	37.9	39.2	CL
56- 68	C1g	0.0	0.6	2.4	5.2	20.4	18.4	40.5	12.5	L	11.0	53.1	23.4	L
68- 95	C2g	0.0	0.7	3.8	5.9	7.3	8.4	57.3	16.6	SiL	12.2	40.0	31.2	CL
95-120	C3g	1.1	3.6	18.8	26.4	28.2	7.1	13.1	2.8	LS	58.9	33.0	5.3	S

Moisture Retention % 1/10 atms	1/3 atms	15 atms	S.G.	EC mmhos/cm 25°C	Moist. at Sat. %	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	$CaCO_3$ %	Free Fe_2O_3 %
	49.2	15.1	2.61	1.40	58.8	6.4	5.3	3.27	16	0.43	1.43
	46.0	18.7	2.64	1.50	58.9	6.6	5.4	3.27	18	0.21	1.42
	44.2	16.1	2.63	1.40	54.3	6.8	5.9	-	16	0.23	1.41
	39.5	14.5	2.63	1.30	48.9	7.0	6.0	2.69	23	0.12	1.61
	34.4	10.9	2.67	1.10	41.8	7.4	6.1	1.37	30	0.29	1.48
	25.0	8.8	2.68	1.10	33.0	7.4	6.0	0.93	11	0.20	1.53
	33.3	10.3	2.68	1.10	35.8	5.6	4.1	1.15	29	-	1.53
	9.4	3.4	2.63	5.10	21.1	3.8	3.2	1.02	15	0.13	0.12

2/ CEC	Extractable Cations me/100g Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations	Elemental Analysis of Clay SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	3/ CEC me/100g
19.2	12.70	5.90	1.00	0.23	-	103.3	-	2.31	54.69	7.85	35.16	37.53
19.2	13.00	5.50	1.23	0.13	-	103.4	-	2.27	54.31	8.50	35.17	-
19.4	13.40	5.60	1.48	0.25	-	106.9	-	2.34	54.58	9.18	33.77	38.53
18.2	12.65	5.60	1.40	0.32	-	109.7	-	2.42	54.99	8.57	32.96	-
15.6	10.50	5.05	1.18	0.31	-	109.2	-	2.19	53.46	10.16	34.97	-
9.5	6.60	3.00	0.86	0.23	-	112.5	-	1.89	48.79	10.19	37.10	-
13.5	5.20	5.20	0.25	0.70	-	84.1	-	2.33	52.77	15.04	28.91	-
4.1	1.90	2.00	0.10	0.23	-	103.2	-	2.47	55.45	8.13	32.85	39.03

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate

3/ Versene Method, 1 N $CaCl_2$ Saturated, NaCl Extracted

Established Series
UKT, JFD
20 October, 1969

HAMCHANG SERIES

The Hamchang series is a member of the coarse loamy, mixed, mesic family of Typic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick dark grayish brown silt loam Apg horizons and moderately deep dark gray or dark grayish brown silt loam cambic Bg horizons with dark yellowish brown mottles. The Cg horizons are gray fine sandy loam with few light olive brown mottles. They are developed on continental alluvial plains in weakly stratified alluvial materials.

Typifying Pedon: Hamchang silt loam - paddy rice (Field description Sangju Gun profile No. 198; colors are for moist soil.)

Ap1g -- 0 to 15 cm. Light olive brown (2.5Y 5/6) silt loam; common fine faint yellowish brown (10YR 5/6) mottles; crushed color light olive brown (2.5Y 5/4) puddled structure breaking to weak fine and coarse granular; friable, slightly sticky and slightly plastic; common fine mica; few fine discontinuous oblique inmass dendritic tubular pores; common fine living and dead grass roots; gradual smooth boundary; pH 5.0.

Ap2g -- 15 to 30 cm. Light olive gray (5Y 6/2) silt loam; many medium to coarse distinct yellowish brown (10YR 5/8) mottles; crushed color pale brown (10YR 6/3); weak coarse subangular blocky and platy structure; firm, sticky and plastic; mica as above; very fine to fine continuous exped simple tubular pores; common very fine and fine living and dead roots; gradual wavy boundary; pH 5.5.

B2g -- 30 to 40 cm. Gray (10Y 4/1) silt loam; common medium to coarse prominent dark yellowish brown (10YR 4/4) mottles; crushed color olive (5Y 4.5/3); weak coarse prismatic structure; friable, sticky and plastic; mica as above; many medium and coarse continuous exped vertical simple tubular pores; many coarse living and dead roots; diffuse smooth boundary; pH 6.5.

B3g -- 40 to 60 cm. Gray (10Y 5/1) silt loam; few fine prominent dark yellowish brown (10YR 4/4) mottles; crushed color gray (10Y 5/1); weak coarse prismatic structure breaking to weak subangular blocky; friable, sticky and very plastic; mica as above; few fine continuous exped vertical simple tubular pores; many medium root channels; clear smooth boundary; pH 6.3.

C1g -- 60 to 100 cm. Grey (10Y 5/1) sandy loam; common medium to coarse olive brown (2.5Y 4/4) mottles along root channels; crushed color olive gray (10Y 4/2); structureless (massive); slightly sticky and plastic; mica as above; few very coarse continuous vertical exped simple tubular pores; many coarse root channels; includes a very thin olive brown (2.5Y 5/6) sand layer; diffuse smooth boundary; pH 6.0.

C2g -- 100 to 150 cm. Olive grey (5Y 5/2) very fine sandy loam; structureless (massive); slightly sticky and slightly plastic; mica as above; few pores; few roots in upper part; pH 6.5.

Type Location: Sangju Gun, Gyeongsangbug Do, 2 km. north west of Gonggeom Station, Pugog Ri, Gonggeom Myeon, in front of Gonggeom Police Box.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is probably greater than 5 meters. Base saturation is more than 60 percent. Reaction is strongly to medium acid. Common fine white and yellow mica occur throughout the profile. Clay content is less than 18 percent and more than 15 percent is coarser than very fine sand. Apg horizons are light olive brown, grayish brown, light olive gray, light gray, gray, grayish brown or dark grayish brown silt loam or loam with common yellowish brown, strong brown or dark yellowish brown mottles. Cambic Bg horizons are dark gray, dark grayish brown or grayish brown sandy loam, silt loam or loam with a few olive brown mottles.

Competing Series and Their Differentiae: These are the Sindab, Subug, Gangdong, Sanchon, Seoggye and Mangyeong soils. The Sindab soils have sandy family textures. The Subug soils have coarse loamy over sandy skeletal textures. The Gangdong soils have fine loamy over sandy textures. The Sachon and Seoggye soils have more mottles, browner colors and imperfect drainage. The Seoggye soils have coarse loamy textures. The imperfectly drained Mangyeong soils have coarse silty textures and occur on fluvio-marine plains.

Setting: The Hamchang soils are developed on continental alluvial plains in stratified alluvial materials. They frequently occur near dyked stream channels which are filled with sands to levels higher than the adjacent alluvial plains. Dominant slopes are about 0.5 percent and range from 0 to 1.5 percent.

Principal Associated Soils: These are the Gangdong, Hagsan and Sindab soils. The Hagsan soils have fine loamy over sandy textures.

Drainage and Permeability: Poorly drained. Permeability is probably moderate and runoff is ponded or very slow. The groundwater table is near the surface except where artifically controlled.

Use and Vegetation: Most of these soils are used for paddy rice.

Distribution and Extent: The Hamchang soils are of small extent and are distributed on broad alluvial plains throughout the country.

Series Established: Gyeongsangnam Do, November 1968.

Lab. Nos. Fr151-156 **Typifying Pedon**

			Particle Size Distribution 1/ (mm) %												
			U. S. Department of Agriculture								International			
Depth cm	Hori- zon	Gra- vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex- tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 15	Ap1g	0.0	1.0	1.6	2.7	5.3	8.8	60.9	19.7	SiL	5.9	29.8	44.6	CL
15- 30	Ap2g	0.0	1.4	2.5	3.4	5.8	8.8	58.7	19.4	SiL	8.0	27.4	45.2	SiCL
30- 40	B2g	0.0	0.7	1.1	2.0	4.0	8.0	63.0	21.2	SiL	4.4	27.6	46.8	SiCL
40- 60	B3g	0.0	0.7	1.8	7.8	15.6	11.0	51.4	11.7	SiL	12.5	42.6	33.2	L
60-100	C1g	0.0	———	4.6	———	21.1	26.4	40.6	7.3	SL	5.6	68.1	19.0	FSL
100-150	C2g	1.4	0.7	1.0	3.1	16.5	31.3	39.5	7.9	VFSL	6.2	69.2	16.7	FSL

Moisture Retention %			Bulk Density	pH		O.M.	Avail. P_2O_5	Free Fe_2O_3	2/ CEC	Extractable Cations				
1/10 atms	1/3 atms	15 atms	g/cc	H_2O (1:1)	1 N KCl	%	ppm	%	me/100g	Ca	Mg	Na	K	H
49.7	42.5	19.3	-	5.1	3.8	1.64	46	1.22	13.10	6.90	3.35	0.11	0.10	0.16
45.1	38.1	15.0	1.17	6.5	5.2	2.27	28	1.38	13.00	9.95	4.35	0.33	0.18	0.05
43.5	37.0	15.0	1.35	5.9	4.3	0.95	14	1.53	11.75	6.80	3.30	0.33	0.18	0.35
40.4	35.7	13.9	-	5.5	4.0	0.63	7	-	5.90	3.25	1.90	0.23	0.15	0.76
33.0	24.2	7.7	1.21	5.4	4.6	0.23	6	-	6.70	1.75	1.60	0.15	0.13	1.81
34.0	22.8	7.1	-	5.3	3.7	0.27	6	-	7.30	2.00	1.05	0.20	0.15	1.66

Base Saturation %	
CEC	Sum of Cations
79.8	82.9
11.3	99.7
90.3	96.8
93.7	87.9
54.2	66.7
46.6	67.2

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
10 November, 1969

HOGYE SERIES

The Hogye series is a member of the loamy skeletal, mixed, mesic family of Fluventic Hapludolls (Alluvial soils). These soils have moderately thick dark brown gravelly loam A horizons and thick dark yellowish brown very gravelly loam cambic B horizons with weak blocky structure. The C horizons are dark yellowish brown weakly stratified very gravelly loam. Hogye soils are developed on alluvial fans and footslopes in alluvial-colluvial materials.

Typifying Pedon: Hogye gravelly silt loam - barley (Field description Ulju Gun profile No. 62; colors are for moist soil unless otherwise indicated)

Ap -- 0 to 12 cm. Dark brown (10YR 3/3) moist, dark yellowish brown (10YR 3/4) dry, gravelly silt loam; moderate very fine and medium granular structure; friable, slightly sticky and slightly plastic; few very fine and fine discontinuous random simple interstitial pores; approximately 8 percent slightly weathered shale gravel; common fine living and dead barley roots; abrupt smooth boundary; pH 5.5.

A1 -- 12 to 19 cm. Dark brown (10YR 3/3) gravelly silt loam; weak medium to coarse subangular blocky structure breaking to fine and medium granular; firm, slightly sticky and slightly plastic; common fine to coarse discontinuous random simple interstitial pores; about 15 percent fragments as above; few roots as above; clear smooth boundary; pH 6.0.

B -- 19 to 60 cm. Dark yellowish brown (10YR 3/4) very gravelly to very cobbly silt loam; weak medium and fine subangular blocky structure breaking to fine, medium and some coarse granular; slightly firm, slightly sticky and slightly plastic; many very fine to coarse discontinuous pores as above; approximately 40 percent by volume slightly weathered subangular shale and some sandstone gravel and cobbles; few roots as above; gradual wavy boundary; pH 5.5.

C -- 60 to 120 cm. Dark brown (10YR 3/3) very gravelly to very cobbly silt loam; structureless (massive), weakly stratified; slightly sticky and slightly plastic; pores as above; 70 percent gravel and cobble as above; few fine to medium roots in upper part; pH 5.5.

Type Location: Ulju Gun, Gyeongsangnam Do, about 100 meters north of Changpyeong Ri, Nongso Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to bedrock is more than 300 cm. in most places and probably ranges from 100 to 500 cm. or more. Base saturation is commonly more than 60 percent. Reaction is strongly to medium acid. Organic matter content ranges from 1.5 to about 5.0 percent in the A horizon and decreases irregularly with depth. Gravel and cobbles generally increase with depth below 50 cm. A horizons are 15 to 25 cm. thick, brown, dark brown, dark yellowish brown or very dark brown in uplands, dark grayish brown, grayish brown or dark gray in rice paddy, gravelly silt loam, loam or light silty clay loam. Only 5 to 20 percent gravel occur in the Ap as farmers generally remove the coarser fragments. Cambic B horizons are about 30 to 85 cm. thick, dark brown, brown or dark yellowish brown very gravelly silt loam, loam or light silty clay loam. B horizon gravel content ranges between 35 and 90 percent by volume and averages about 50 percent. C horizons are variably stratified dark yellowish brown or brown very gravelly to very cobbly silt loam, loam or very fine sandy loam becoming coarser with depth.

Competing Series and Their Differentiae: These are the Daeyang, Maji, Seogto, Iweon, Banho and Mui series. The Daeyang soils have less than 35 percent coarse fragments. The Maji soils have neutral reaction, somewhat darker colors and are derived from limestone materials. The Seogto soils contain larger coarse fragments and occur in steeper mountain valleys. The Iweon and Mui soils have coarse loamy textures and medium to low base saturation. The Iweon soils have yellower colors in the control section. The Banho soils have paler colors and less than 35 percent coarse fragments.

Setting: The Hogye soils occur on very gently to gently sloping alluvial fans and footslopes and are formed in alluvial and alluvial-colluvial materials derived from mixed noncalcareous sources. Dominant slopes are 2 to 7 percent and range from 1 to 15 percent.

Principal Associated Soils: These include the Seogto, Togye, Hwabong, Hwangyong, Bonryang and Mudeung soils. The Togye soils have coarser fine gravelly, sandy textures and are associated in similar positions. Soils of the Hwabong, Hwangyong and Bonryang series have coarser textures and occur on alluvial plains below the Hogye soils. The Hwangyong soils are sometimes associated in similar positions. The Mudeung soils frequently occur in the associated mountains.

Drainage and Permeability: Well drained. Permeability is moderately rapid and runoff is probably medium. The fluctuating ground water table is probably between 200 and 500 cm.

Use and Vegetation: These soils are used for tobacco, cucumber, red pepper, onion, radish, potato, squash, melon, water melon, barley, soybean, wheat and similar upland crops because sufficient irrigation water is generally unavailable for paddy rice.

Distribution and Extent: These soils are of moderate extent andoccur in small scattered areas at the foot of mountains throughout the country.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966.

Remarks: Most coarse fragments were not included in the soil samples analyzed for the typifying pedon.

Lab. Nos. U349-352 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 12	Ap	0.0	4.2	4.6	5.1	9.4	8.2	53.7	14.8	SiL	15.8	40.2	29.2	L
12- 19	A1	20.6	3.9	4.2	4.8	9.1	7.0	57.9	12.4	SiL	14.7	35.7	35.4	L
19- 60	B	15.4	2.5	3.8	4.3	7.4	5.7	56.0	20.3	SiL	12.0	31.5	36.2	CL
60-120	C	11.5	2.3	2.6	3.0	7.8	7.6	54.7	22.0	SiL	9.1	37.7	31.2	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	S.G.	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg	Na	K	H
							me/100g					
	28.7	10.1	2.60	5.7	4.5	3.20	11.30	4.95	2.05	1.18	0.08	-
	26.3	8.9	2.65	5.2	3.7	2.20	8.90	3.10	1.40	0.15	0.53	-
	25.2	9.9	2.68	5.2	3.7	1.90	10.60	4.60	1.65	0.20	0.33	-
	26.7	9.7	2.71	5.2	3.5	1.20	11.50	5.10	1.40	0.20	0.08	-

Base Saturation % CEC	Sum of Cations	Elemental Analysis of Clay: Igni loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	3/ CEC me/100g
73.1	-	0.07	3.04	58.79	9.17	27.00	32.53
58.2	-	-	-	-	-	-	-
64.0	-	-	-	-	-	-	-
59.0	-	-	2.35	52.83	9.85	31.83	42.54

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, NaCl Extracted

HONAM SERIES

The Honam series is a member of the fine clayey, mixed, mesic family of Typic Ochraqualfs (Low-Humic Gley soils). These soils have dark grayish brown silty clay loam Apg horizons and deep dark grey silty clay Btg horizons with common yellowish red and yellowish brown mottles. Cg horizons are gray to dark gray silty clay. This series is on low terraces in broad alluvial plains in alluvium derived from continental materials.

Typifying Pedon: Honam silt loam - paddy rice (Field description Gwangsan Gun profile No. 81; colors are for moist soil.)

Ap1 -- 0 to 10 cm. Olive gray (5Y 5/2) wet, silt loam; common fine prominent strong brown (7.5YR 5/6) mottles; puddled, structureless (massive); friable, sticky and plastic; many fine rice roots; abrupt smooth boundary.

Ap2g -- 10 to 16 cm. Olive gray (5Y 4/2) wet, silt loam; few fine prominent dark brown (7.5YR 4/4) mottles; weak coarse blocky and platy structure; friable, sticky and plastic; common fine rice roots; clear smooth boundary.

B1tg -- 16 to 23 cm. Olive gray (5Y 5/2) silty clay loam; common fine prominent yellowish red (5YR 4/6) mottles; moderate coarse prismatic structure breaking to moderate coarse angular blocky; thin continuous exprism clay cutans; firm, very sticky and very plastic; few fine rice roots; clear smooth boundary.

B21tg -- 23 to 35 cm. Dark gray (5Y 4/1) silty clay; common medium prominent yellowish brown (10YR 5/6) inprism mottles; moderate coarse prismatic structure breaking to strong coarse and medium angular blocky; thin continuous clayey cutans; firm, very sticky and very plastic; few fine rice roots; gradual smooth boundary.

B22tg -- 35 to 53 cm. Dark gray (5YR 4/1) silty clay; common fine prominent strong brown (7.5YR 5/6) inprism mottles; moderate coarse prismatic structure breaking to strong coarse angular blocky; thin continuous grayish brown (10YR 5/2) clayey cutans; firm, very sticky and very plastic; few fine rice roots; gradual smooth boundary.

B23tg -- 53 to 120 cm. Very dark gray (5YR 3/1) wet, silty clay; many coarse prominent brown (7.5YR 5/4) inprism mottles; weak coarse prismatic structure with continuous gray clayey cutans; firm, very sticky and very plastic; no roots.

Type Location: Gwangsan Gun, Jeollanam Do, about 300 meters southeast of Yogi Ri, Donggog Myeon.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. or more and depth to hard rock is probably more than 5 meters. Base saturation is more than 60 percent. Reaction is medium, increasing to neutral in the lower horizons. Apg horizons are thin or moderately thick gray, grayish brown, dark grayish brown or olive gray silt loam, silty clay loam or loam with yellowish red, strong brown or yellowish brown mottles. The Btg horizons are olive gray, grayish brown or dark gray silty clay, silty clay loam, clay or clay loam with yellowish brown, strong brown, yellowish red or reddish brown mottles. Cg horizons are gray, dark gray or dark grayish brown silty clay, clay or silty clay loam, weakly stratified.

Competing Series and Their Differentiae: These include the Gongdeog, Sugye, Geugrag and Gimje series. The Gongdeog soils have thick black peaty mineral substrata and occur on fluvio-marine plains. The Sugye soils have fine silty textures, grayer colors throughout and less mottles. The Geugrag soils have more yellow colors, somewhat better drainage and more mottles throughout the profiles. The Gimje soils have cambic Bg horizons, contain thin peaty layers in the Cg horizons and are formed on the fluvio-marine plains.

Setting: The Honam soils occur on level to nearly level low river terraces on broad alluvial plains in stratified continental alluvial materials. Slopes are dominantly about 0.5 percent, and range from 0 to 2 percent.

Principal Associated Soils: The Sinheung, Hyocheon, Yeongsan and Geugrag soils are associated with the Honam soils in similar physiographic positions. The Sinheung soils have fine loamy textures. The Hyocheon soils have Fe_2CO_3 mottles below 50 cm. The Yeongsan soils have fine loamy over sandy textures. The Geugrag soils are associated in slightly higher terrace positions.

Drainage and Permeability: Poorly drained. Permeability is very slow and runoff is slow or ponded.

Use and Vegetation: Most areas are used for paddy rice and some of the artificially drained areas are used also for barley or wheat.

Distribution and Extent: The Honam soils are of relatively large extent and occur on broad alluvial plains throughout the country.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Remarks: Coarse textured soil materials have apparently been added to the Ap horizon by farmers to improve the workability of the typifying pedon. The drainage of this series was considered as imperfect before placement in the new classification system because double crops can be grown.

Lab. Nos. K133-138 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % U.S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	Ap1g	0.8		2.2		1.8	1.2	71.4	23.4	SiL	2.6	22.5	51.5	SiCL
10- 16	Ap2g	0.5		2.6		1.8	1.3	73.0	21.3	SiL	2.9	10.4	65.4	SiCL
16- 23	B1tg	0.2		0.6		0.4	0.4	62.3	36.3	SiCL	0.7	16.5	46.5	SiC
23- 35	B21tg	0.2		0.4		0.1	0.2	54.9	44.4	SiC	0.4	8.2	47.0	SiC
35- 53	B22tg	0.0		0.4		0.2	0.2	51.7	47.5	SiC	0.4	11.4	40.7	HC
53-120	B23tg	0.2		0.6		0.3	0.5	54.9	43.7	SiC	0.6	14.5	41.2	LiC

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail P_2O_5 ppm	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H
	37.2	10.0	4.9	4.1	2.10	60	7.10	3.50	1.20	0.19	0.20	-
	38.3	9.6	4.8	3.8	2.20	58	6.90	2.85	1.00	0.15	0.15	-
	32.0	13.2	6.1	5.0	1.00	-	7.90	5.10	2.45	0.10	0.05	-
	34.6	15.8	6.4	5.2	0.90	-	10.80	6.60	3.55	0.33	0.16	-
	36.2	21.3	6.1	5.0	0.80	-	15.00	8.20	5.45	0.43	0.20	-
	35.4	19.0	5.8	4.6	0.80	-	19.00	9.75	7.60	0.63	0.26	-

Base Saturation %: CEC	Sum of Cations	Elemental Analysis of Clay: H_2O %	Igni loss%	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	3/ CEC me/100g
71.7	-	4.88	10.96	2.24	46.71	8.90	29.67	2.99	27.08
60.1	-	-	-	-	-	-	-	-	-
97.5	-	4.57	11.04	2.00	44.74	12.15	30.29	2.78	22.56
98.5	-	-	-	-	-	-	-	-	-
95.2	-	5.76	11.45	1.99	43.85	13.10	28.99	2.26	27.58
96.0	-	-	-	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, 1 N CaCl Extracted

Established Series
UKT, KDH, JFD
10 November, 1969

HWABONG SERIES

The Hwabong series is a member of the sandy, mixed mesic family of Typic Udipsamments (Alluvial soils). These soils have thin yellowish brown or dark yellowish brown loamy sand surface horizons and very deep yellowish brown stratified loamy sand and sand substrata. This series comprises recent coarse textured alluvial deposits mostly on river levees on broad alluvial plains.

Typifying Pedon: Hwabong loamy sand - mulberry (Field description Ulju Gun profile No. 72; colors are for moist soil.)

Ap -- 0 to 11 cm. Brown to dark brown (10YR 4/3) loamy sand; moderate granular structure; very friable, nonsticky and nonplastic; few very fine and fine discontinuous random simple tubular pores; many fine white mica flakes; approximately 7 percent medium shale, andesite porphyry and granite gravel; many very fine and medium living barley and dead wild grass roots; abrupt smooth boundary; 9 to 15 cm. thick.

C1 -- 11 to 39 cm. Yellowish brown (10YR 5/4) gravelly loamy coarse sand or sand; structureless (single grain); loose; approximately 30 percent gravel as above; common roots as above; clear smooth boundary; 25 to 30 cm. thick.

C2 -- 39 to 53 cm. As above with approximately eight percent gravel; few roots as above; 13 to 17 cm. thick.

C3 -- 53 to 130 cm. As above sandy loam; less gravel; 75 to 81 cm. thick.

C4 -- 130 to 150 cm. Dark yellowish brown (10YR 4/4) fine sandy loam; as above; no roots; abrupt smooth boundary; 18 to 21 cm. thick.

C5 -- 150 to 175 cm. Yellow (10YR 7/8) gravelly sand; structuress (single grain); loose.

Type Location: Ulsan City, Gyeongsangnam Do, about 500 meters west of Daun Ri.

Range in Characteristics: Depth to bedrock is commonly more than 3 meters and probably ranges to 5 meters or more. Reaction is strongly to slightly acid throughout the control section. Base saturation ranges from medium to high. The thickness of the Ap horizons averages about 10 cm. and ranges between 5 and 15 cm. Ap horizons are brown to dark brown, dark yellowish brown or yellowish brown, loamy sand, sand or sandy loam. C horizons to a depth 150 cm. are stratified yellowish brown, light yellowish brown, light olive brown or pale brown medium or coarse sand or loamy sand. Up to 10 percent gravel may occur throughout the profile and gravelly or cobbly strata may occur below 150 cm.

Competing Series and Their Differentiae: These include the Myeongji, Nagdong, Togye, Hwangryong Ibseog and Bonryang series. The Myeongji soils have moderately thick dark A horizons and contain gray mottles between 50 and 100 cm. The Nagdong soils have brown colors and fine sand or loamy fine sand textures. The Togye soils have gravelly sandy textures throughout and occur in local valley footslope and alluvial fan positions. The Hwangryong and Ibseog soils belong to the sandy skeletal texture family. The Bonryang soils have coarse loamy over sandy textures.

Setting: The Hwabong soils occur on continental river levees and flood plains adjacent to stream and river channels. Dominant slopes are 1 to 2 percent ranging from 0 to 3 percent.

Principal Associated Soils: The associated soils occur in similar physiographic positions usually in higher more sloping valley alluvium. Generally, the Hwabong soils are adjacent to the inland portion of Riverwash. The Jungdong, Nagdong and Bonryang soils are also associated.

Drainage and Permeability: Excessively drained. Very rapid permeability. Runoff is slow.

Use and Vegetation: Approximately 70 percent of the Hwabong soils are used for cultivated upland crops such as rye, buck wheat, melon, water melon and vegetables. The remaining portion is used chiefly for poplar trees.

Distribution and Extent: The Hwabong soils are of moderate extent and occur along the contine rivers throughout the country.

Series Established: Ulju Gun, 1967.

Remarks: The typifying pedon contains more gravel above 150 cm. than is characteristic for the series.

Lab. Nos. U410-415 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	Intl. CS 2-.2	Intl. FS .2-.02	Intl. Silt .02-.002	Textural Class
			Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture								International			
0- 11	Ap	7.0	2.4	10.9	18.8	33.9	15.9	15.9	3.1	LS	40.1	50.7	6.1	S
11- 39	C1	38.7	11.4	30.0	25.7	17.0	4.8	9.6	1.5	S	73.3	20.9	4.3	S
39- 53	C2	9.0	9.4	20.2	34.3	21.3	5.2	8.8	0.8	S	72.0	24.4	2.8	S
53-130	C3	2.6	2.8	15.5	35.7	24.5	7.8	11.4	2.3	S	63.2	28.1	6.4	S
130-150	C4	2.7	1.4	5.1	18.7	49.0	11.3	13.4	1.1	S	39.0	50.1	9.8	S
150-175	C5	9.6	6.9	17.1	28.3	28.7	6.8	10.9	1.3	S	61.1	28.3	9.3	S

Moisture Retention % 1/10 atms	1/3 atms	15 atms	S.G.	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	Free Fe_2O_3 %	2/ CEC	Ca	Mg	Na	K	H
										Extractable Cations me/100g				
	8.96	3.73	2.67	6.2	4.4	0.70	22	0.84	4.60	2.60	0.80	0.03	0.10	-
	3.67	1.87	2.65	6.8	5.5	0.20	5	0.44	2.00	1.20	0.50	0.03	0.08	-
	5.54	2.42	2.67	6.9	4.7	0.20	5	0.47	2.70	1.70	0.80	0.03	0.08	-
	6.51	2.70	2.68	6.8	4.6	0.20	5	0.60	3.30	2.40	0.50	0.03	0.08	-
	8.14	3.39	2.70	6.5	4.4	0.10	6	0.93	4.70	3.25	1.30	0.08	0.10	-
	5.35	2.44	2.67	6.7	4.5	0.20	5	0.56	3.80	2.15	0.75	0.08	0.08	-

Base Saturation % CEC	Sum of Cations
76.7	-
90.5	-
96.7	-
91.2	-
100.6	-
80.5	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KBJ, JFD
7 November, 1969

HWADONG SERIES

The Hwadong soils are members of the fine clayey, mixed, mesic family of Aquic Hapludalfs (Red-Yellow Podzolic soils with high base status). They have thin grayish brown silty clay loam Apg horizons, deep yellowish red silty clay Bt horizons with gray mottles in the B3 and increasing with depth. C horizons are mottled brown and gray silty clay. These soils are developed on slightly and moderately elevated continental river terraces derived mainly from granitic rocks and shale.

Typifying Pedon: Hwadong silty clay loam - rice paddy (Field description Dalseong Gun No. 96; colors are for moist soil.)

Ap1g -- 0 to 15 cm. Grayish brown (2.5Y 4/2) silty clay loam; few fine faint light olive brown mottles; puddled structure, breaking to moderate medium granular; friable, sticky and plastic; many fine grass roots; few fine pores; abrupt smooth boundary; pH 5.2.

Ap2g -- 15 to 20 cm. Grayish brown (2.5Y 5/2) silty clay loam; many medium and coarse prominent yellowish red (5YR 4/6) inmass mottles; crushed color yellowish brown to dark yellowish brown (10YR 5/4-4/4); structureless (massive); friable, sticky and plastic; common fine grass roots; common fine pores; clear smooth boundary; pH 5.6.

B1g -- 20 to 40 cm. Dark grayish brown (10YR 4/2) silty clay loam; common fine faint yellowish brown (10YR 5/6) mottles; many fine to medium brittle Mn concretions; crushed color brown to yellowish brown (10YR 5/3.5); moderate medium prismatic structure, breaking to moderate medium subangular blocky; firm, sticky and plastic; thin gray (10YR 4/1) clay cutans on prisms; common fine roots and pores; gradual irregular boundary; pH 6.2.

B2t -- 40 to 90 cm. Strong brown (7.5YR 5/6) silty clay; many medium faint yellowish brown (10 YR 5/4) mottles; crushed color brown to yellowish brown (10YR 5/5); moderate coarse prismatic structure breaking to moderate medium to fine subangular blocky; firm, very sticky and very plastic; thin brown (10YR 5/4) clayey cutans; common fine pores; clear wavy boundary; pH 6.5.

B3t -- 90 to 150 cm. Yellowish red (5YR 5/8) silty clay; many medium distinct pale brown (10YR 6/3) and common medium distinct black inprism (Mn) mottles; moderate very coarse prismatic structure diminishing with depth; firm, very sticky and very plastic; few coarse pores; thick light brownish gray (2.5Y N2/) clay cutans on prisms becomes more gray with depth; pH 6.6.

Type Location: 30 meters east of 2 Gu, Dunsan, Daegu City, Gyeongsangbug Do.

Range in Characteristics: Soil reaction ranges from strongly acid to slightly acid and base saturation exceeds 60 percent. Solum thickness is 125 to 150 cm. or more and depth to hard rock is generally more than 3 meters. Apg horizons are 10 to 20 cm. thick, dark grayish brown to grayish brown silt loam, clay loam and silty clay loam with strong brown and yellowish red mottles where used for paddy rice or brown to dark brown where used for upland crops. B1 horizons are dark grayish brown or grayish brown silty clay loam or clay loam with yellowish brown, strong brown or yellowish red mottles in paddy. Crushed colors of the B1 horizon are brown to yellowish brown. B2t horizons are yellowish red, strong brown or reddish brown silty clay, light clay, heavy clay loam or heavy silty clay loam. When in rice paddy, Bt horizons have a layer more than 10 cm. thick free of mottles of 2 chroma or less. This layer normally is between 40 and 70 cm. Thick B3 horizons beginning between 70 and 125 cm. are similar to B2 horizons except for having 2 chroma or less mottles. C horizons have paler colors and contain more gray mottles than B3 horizons. They are yellowish brown, strong brown or yellow with common gray and few red mottles. They may be silty clay loam, silty clay or clay loam with minor strata of other textures and contain few or no pebbles.

Competing Series and Their Differentiae: These include the Bancheon, Changpyeong, Geugrag, Gwangju, Banggi, Pyeongan, Wangsan and Gongseong soils. Bancheon, Changpyeong and Gwangju soils have red colors, lack gray subsoil mottles and occur in higher physiographic positions. The Geugrag soils have yellowish brown subsoil colors with gray mottles throughout and occur on slightly lower terraces. The Banggi soils have redder colors and clayey skeletal textures. The Pyeongan soils are higher in reaction, are formed from limestone materials, are better drained and lack gray mottles in the solum. The Wangsan soils have thin dark brown surfaces, redder subsoil colors, are free of gray mottles in the B horizon and are better drained. The Gongseong soils occur on slightly lower less dissected terraces and lack ground water tables in the B3 horizons.

Setting: The Hwadong soils occur on nearly level to sloping terraces formed in slight to moderately dissected continental old alluvium derived from mixed materials. Dominant slopes are 2 to 7 percent and the range is from 2 to 15 percent.

Principal Associated Soils: The Bancheon, Geugrag, Banggi, Honam and Jangyu soils may be associated with the Hwadong soils. The Bancheon and Banggi soils are associated on slightly higher terraces and the Geugrag and Jangyu soils are associated on slightly lower terraces. The Honam soils are associated on low terraces. A wide variety of residual soils are associated in uplands.

Drainage and Permeability: Moderately well drained. Permeability is very slow and runoff is very slow as most areas are level terraced and dyked for paddy rice land use.

Use and Vegetation: Most areas of these soils are used for flood irrigated rice during wet summers and nonirrigated barley, wheat or vegetables during the dry winter and spring seasons.

Distribution and Extent: The soils of the Hwadong series occur along the major rivers and streams throughout the country particularly where they join. The extent is low.

Remarks: Possibly some of areas correlated as Hwadong which were derived from shale and have higher base saturation and pH than those in granitic areas should be separated as a different series.

Lab. Nos. T260-264 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 15	Ap1g	6.1	1.5	2.6	2.4	2.9	2.6	57.1	30.9	SiCL	7.1	18.4	43.6	LiC
15- 20	Ap2g	7.0	1.6	2.7	2.3	2.7	2.2	57.3	31.2	SiCL	7.2	17.6	44.0	LiC
20- 40	B1g	6.1	2.4	3.9	2.5	2.5	1.8	56.3	30.6	SiCL	9.3	19.6	40.5	LiC
40- 90	B2t	0.6		1.8		0.8	0.7	41.1	55.6	SiC	2.0	9.3	33.1	HC
90-150	B3t	0.5	1.0	2.0	1.7	2.8	2.3	49.2	40.9	SiC	5.3	15.5	38.3	LiC

Moisture Retention %			Atterberg Limits %		pH		O.M.	Avail.	2/	Extractable Cations				
1/10 atms	1/3 atms	15 atms	LL	PI	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H
									me/100g					
	36.9	14.6	40.0	14.0	5.1	4.1	2.70	97	12.74	6.50	1.80	0.26	0.22	-
	33.1	16.9	38.0	16.0	5.5	4.4	1.57	30	12.36	6.70	2.10	0.32	0.16	-
	28.8	14.1	36.0	16.0	6.2	4.9	0.76	-	14.24	8.60	2.80	0.28	0.14	-
	35.1	22.1	61.0	40.0	6.2	5.3	0.40	-	17.76	11.40	3.40	0.34	0.42	-
	34.2	20.1	46.0	24.0	6.6	5.6	0.20	-	15.78	8.00	3.80	0.28	0.40	-

Base Saturation %	
CEC	Sum of Cations
69.0	-
75.0	-
83.0	-
88.0	-
79.0	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
7 November, 1969

HWANGRYONG SERIES

The Hwangryong series is a member of the sandy skeletal, mixed, mesic family of Typic Udipsamments (Alluvial soils). These soils have thin brown gravelly loamy sand A horizons and very deep pale brown very gravelly to very cobbly loamy sand or sand C horizons. They are formed in weakly stratified very gravelly and very cobbly mixed alluvium on very gently sloping alluvial plains in continental mountain valleys.

Typifying Pedon: Hwangryong gravelly loamy sand - wheat (Field description Ulju Gun profile No. 106; colors are for moist soil.)

Ap -- 0 to 14 cm. Brown (10YR 5/3) gravelly loamy sand; moderate medium granular structure; loose, nonsticky and nonplastic; about 15 percent round mainly granite gravel and cobbles; gravel and many very fine and fine biotite and muscovite mica flakes; common fine and coarse living roots; clear smooth boundary; pH 5.5.

C -- 14 to 150 cm. Very pale brown (10YR 7/4) very gravelly and very cobbly coarse sand; structureless (single grain); about 50 percent round gravel and cobbles as above; few fine and medium living roots; pH 5.5.

Type Location: Ulsan City, Gyeongsangnam Do, about 300 meters west of Samho bridge, Daun Dong.

Range in Characteristics: Generally 10 to 35 percent gravel occur above 50 cm. and 35 to 90 percent gravel stratified with sand and loamy sand commonly increasing with depth occur in the substrata. Base saturation is more than 60 percent. Reaction is medium to slightly acid throughout the profiles. A1 or Ap horizons, usually less than 20 cm. thick, are brown, dark brown or dark yellowish brown gravelly and or cobbly loamy sand, sandy loam or sand. When used for rice paddy, the surface is mottled grayish brown, dark grayish brown or gray due to reduction under irrigation water. C horizons are brownish yellow, light yellowish brown, pale brown or very pale brown very gravelly and or very cobbly loamy sand or sand.

Competing Series and Their Differentiae: These are the Ibseog, Togye, Hwabong, Nagdong, Jungdong and Hogye series. Ibseog soils lack cobbles and coarse gravel, contain fine angular gravel through the profile and occur on local alluvial fans above the flood plains. The Togye soils have gravelly sandy textures and occur on local alluvial fans not subject to flooding. The Hwabong soils have sandy textures and occur on river levees subject to flooding except where dyked. The Nagtong soils have fine sandy textures and occur on broad alluvial plains. The Jungdong soils have coarse loamy textures and occur on broad alluvial plains. The Hogye soils have dark surface colors, loamy skeletal textures and occur chiefly on alluvial fans above the flood plains.

Setting: The Hwangryong soils are on level to nearly level flood plains adjacent to stream or river channels and on large alluvial fans in mountainous areas. Source materials are derived dominantly from soils formed in granitic, schist, phyllite, andesite porphyry and to less extent shale areas. Dominant slopes are about 1 or 2 percent and the range is from 0.5 to 4 percent.

Drainage and Permeability: Excessively drained. Very rapid permeability. Runoff is slow.

Use and Vegetation: About 80 percent is used for nonirrigated upland crops such as barley, soybean, mulberry and orchard. Paddy rice is grown only to a limited extent, usually in areas where streams can be diverted through the paddies. A few areas are idle.

Distribution and Extent: The Hwangryong soils are of moderate extent and occur along the continental portion of most rivers in mountainous areas.

Series Established: Ulju Gun, Gyeongsangnam Do, 1967.

Remarks: The larger fragments were not included in the mechanical analysis.

Lab. Nos. U566-567 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 14	Ap	4.4	2.3	5.1	11.9	46.5	15.4	13.4	5.4	LS	30.4	58.0	6.2	LFS
14-150	C	37.2	12.9	29.1	30.7	15.0	3.2	6.0	3.0	S	79.7	14.3	3.0	S

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
	9.1	4.1	6.4	4.3	0.24	11	3.20	2.65	1.25	0.07	0.03	0.10	125.0	97.6
	4.2	2.3	6.8	4.7	0.44	9	1.50	1.25	0.65	0.02	0.02	0.05	129.3	97.5

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KBJ, JFD
6 November, 1969

HYOCHEON SERIES

The Hyocheon series is a member of the fine loamy, mixed, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick dark grayish brown silt loam Ap horizons and moderately deep olive gray or dark gray clay loam cambic B horizons mottled with brown over very deep dark gray silty clay loam Cg horizons with ferrous carbonate mottles. These soils are in local valleys adjacent to broad alluvial plains.

Typifying Pedon: Hyocheon silt loam - rice paddy (Field description Gwangsan Gun profile No. 86; colors are for moist soil.)

Ap1g -- 0 to 9 cm. Olive gray (5Y 4/2) silt loam; common fine prominent yellowish red (5YR 4/8) mottles; puddled, structureless (massive); friable, sticky and plastic; few very fine pores; many fine roots; abrupt smooth boundary; pH 5.5.

Ap2g -- 9 to 21 cm. Dark grayish brown (2.5Y 4/2) light clay loam; common fine and medium prominent strong brown (7.5YR 5/8) inmass mottles; weak coarse platy structure; firm, sticky and plastic; few fine root holes; common fine roots; clear smooth boundary; pH 7.0.

B11g -- 21 to 32 cm. Olive gray (5Y 4/2) clay loam; common coarse distinct dark grayish brown (10Y 4/4) inprism mottles; moderate coarse prismatic structure breaking to moderate coarse and medium subangular blocky; firm, sticky and plastic; very thin gray clayey cutans; clear smooth boundary; pH 6.5.

B12g -- 32 to 47 cm. Olive gray (5Y 5/2) clay loam; many coarse prominent strong brown (7.5YR 5/6) inprism mottles; crushed color light olive brown (2.5Y 5/4); moderate very coarse prismatic structure breaking to moderate coarse subangular blocky; firm, sticky and plastic; thin discontinuous olive gray (5Y 4/2) clayey cutans; very few fine roots; clear smooth boundary; pH 6.5.

B2g -- 47 to 77 cm. Gray (5Y 5/1) light clay; few fine very dark brown (10YR 2/2) Mn mottles and many coarse and medium strong brown (7.5YR 5/6) inprism mottles; crushed colors are dark yellowish brown (10YR 4/4); moderate very coarse prismatic structure breaking to moderate coarse and medium subangular blocky; firm, very sticky and very plastic; thin continuous gray clayey cutans; common medium root holes; very few very fine roots; clear smooth boundary; pH 6.5.

B3g -- 77 to 95 cm. Dark gray (5Y 4/1) light clay; common fine prominent strong brown (7.5YR 5/6) and pale yellow (5Y 7/3) ferrous carbonate inprism mottles; very weak very coarse prismatic structure; firm, very sticky and very plastic; patchy thin gray clayey cutans in common medium root holes and on prism faces; clear smooth boundary; pH 6.5.

C1g -- 95 to 120 cm. Dark gray (5Y 4/1) light clay; few fine and medium white ferrous carbonate mottles and soft inmass concretions; structureless (massive); firm, very sticky and very plastic; pH 6.5.

Type Location: Gwangju City, Jeollanam Do, about 200 meters south of the Provincial Office of Rural Development on the PORD Experiment Station, Nongseong Dong.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. Reaction is slightly acid to neutral throughout and ferrous carbonate mottles occur below 50 to 100 cm. Ag horizons are 20 to 30 cm. thick, dark grayish brown or gray to dark olive gray silt loam, loam, light clay loam or light silty clay loam with distinct or prominent mottles. Bg horizons are 50 to 90 cm. thick, olive gray, gray to dark gray or dark grayish brown clay loam, silty clay loam or heavy loam with common distinct or prominent inped mottles of strong brown, yellowish brown or yellowish red. Cg horizons are very deep, dark gray, olive gray or grayish brown silty clay loam, silty clay, silt loam and loam with yellow to white ferrous carbonate mottles and soft concretions.

Competing Series and Their Differentiae: These are the Sinheung, Honam, Sugye and Jisan soils. The Sinheung and Jisan soils lack ferrous carbonate. The Honam soils have fine clayey textures and lack ferrous carbonate. The Sugye soils lack ferrous carbonate, belong to the fine silty texture family and have grayer colors.

Setting: Level to nearly level local valley alluvial plains and the junction of local alluvial fans with broad alluvial plains. Slopes are less than 2 percent.

Principal Associated Soils: The Honam, Sugye and Geugrag soils are associated on brood alluvial plains. The Jisan, Baeggu and Yongji soils are associated in local valley areas. The Gwangsan, Jeonnam, Songjeong and similar soils may be associated in uplands.

Drainage and Permeability: Poorly drained. Permeability is slow or very slow. Runoff is moderately slow or slow. Depth to the ground water table ranges between about 50 and 100 cm. where artificially controlled.

Use and Vegetation: Most of these soils are used for flood irrigated rice during the wet summer and to nonirrigated barley during the dry winter and spring seasons.

Distribution and Extent: The Hyocheon series is of small extent and is known to occur only in the south-western part of the country.

Series Established: Gwangju City, Jeollanam Do, 1966.

Remarks: The 2 chroma soil colors above 77 cm. in the typifying pedon, prismatic structure, apparent clayey cutans and the concentration of unmottled gray colors in the vicinity of prism exteriors is due, at least in part, to wetting and drying and reduction resulting from fluctuating water tables, long time use for flood irrigated rice during the summer and autumn seasons and nonirrigated dry land crops in other seasons.

Lab. Nos. K152-158 Typifying Pedon

Depth cm	Hori- zon	Gra- vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex- tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 9	Ap1g	1.6	1.7	4.3	4.9	7.7	5.2	50.6	25.6	SiL	12.7	23.3	38.4	LiC
9- 21	Ap2g	2.6	2.1	8.1	9.7	4.8	1.4	47.8	25.4	L	22.0	8.5	44.1	LiC
21- 32	B11g	1.1	3.3	5.6	5.8	7.6	4.5	45.3	27.9	CL	16.3	20.0	35.8	LiC
32- 47	B12g	2.3	3.1	6.7	6.5	7.5	4.2	42.7	29.3	CL	18.0	18.3	34.4	LiC
47- 77	B2g	1.6	2.2	4.1	4.0	4.8	2.6	45.5	36.8	CL	11.4	14.6	37.2	LiC
77- 95	B3g	0.5	2.2	4.8	4.5	5.3	3.2	47.7	32.3	CL	12.6	19.3	35.8	LiC
95-120	C1g	0.7	1.6	2.8	2.8	3.6	2.6	53.2	33.4	SiCL	7.9	18.3	40.4	LiC

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H
	38.9	15.5	1.02	4.9	3.9	2.80	11.6	6.00	2.20	0.40	0.40	-
	35.8	15.7	1.02	5.2	4.3	2.36	11.1	7.00	2.40	0.38	0.18	-
	34.4	16.9	1.40	6.6	5.5	1.28	11.5	8.70	3.80	0.35	0.08	-
	35.4	15.8	1.40	6.7	5.5	0.51	10.6	7.90	3.40	0.28	0.10	-
	40.5	20.2	1.21	5.7	4.6	1.23	12.9	7.60	4.00	0.25	0.13	-
	35.4	15.4	-	5.5	4.1	1.74	10.9	5.60	3.00	0.18	0.08	-
	37.2	16.4	1.14	5.2	4.0	2.25	12.6	5.80	3.20	0.15	0.08	-

Base Saturation % CEC	Sum of Cations	Elemental Analysis of Clay: SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	3/ CEC me/100g
77.6	-	1.94	44.72	8.88	33.54	2.18	30.03
89.7	-	-	-	-	-	-	-
112.4	-	1.91	43.88	9.97	32.56	1.70	29.02
110.2	-	1.88	43.61	9.71	33.09	1.89	-
92.9	-	1.99	45.48	8.68	33.24	1.55	27.52
81.3	-	2.19	47.36	6.25	22.77	1.94	28.52
73.3	-	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N - $CaCl_2$ Saturated, NaCl Extracted

Established Series
UAT, JFD
11 November, 1969

IBSEOG SERIES

The Ibseog series is a member of the sandy skeletal, mixed, mesic family of Typic Udipsamments (Alluvial soils). These soils have thin brown to dark brown fine gravelly loamy coarse sand Ap horizons and very deep yellowish brown very gravelly sand or loamy coarse sand C horizons. They occur in gently sloping to sloping mountain foot slopes and alluvial fan physiographic positions and are derived from local alluvial granitic materials.

Typifying Pedon: Ibseog fine gravelly loamy coarse sand-tobacco (Field description Andong Reservoir Survey profile No. 5; colors are for moist soil.)

Ap -- 0 to 10 cm. Brown to dark brown (10YR 4/3) fine gravelly loamy coarse sand; moderate fine granular structure; friable, nonsticky and nonplastic; many fine to medium white and yellow mica flakes; common fine to medium tobacco roots; about 30 percent fine angular quartz gravel; clear smooth boundary.

C1 -- 10 to 30 cm. Brown (10YR 5/3) fine very gravelly sand; structureless (single grain); loose, nonsticky and nonplastic; common mica as above; about 60 percent fine angular quartz gravel; common roots as above; abrupt smooth boundary.

C2 -- 30 to 120 cm. Yellowish brown (10YR 5/4) fine very gravelly loamy coarse sand; structureless (single grain); loose, nonsticky and nonplastic; mica as above, about 50 percent fine angular quartz gravel; no roots.

Type Location: Andong Gun, Gyeongsangbug Do, about 200 meters south of Saweol Dong, Weolgog Myeon.

Range in Characteristics: Soil depth is more than 100 cm. and depth to hard rock is commonly more than 3 meters. Base saturation is more than 60 percent. Reaction is slightly to medium acid. 35 to 90 percent fine angular gravel occurs throughout the C horizons. Common to many mica flakes occur throughout the profiles. Ap horizons are brown to dark brown, light yellowish brown or brownish yellow fine angular gravelly loamy coarse sand, sand, coarse sand or coarse sandy loam. C horizons are yellowish brown, brownish yellow, yellow or brown with hues of 7.5YR or 10YR fine angular very gravelly loamy coarse sand, coarse sand or sand.

Competing Series and Their Differentiae: These include the Togye, Hwabong, Hwangryong, Iweon, Jungdong and Sangju series. The Togye soils have less than 35 percent gravel. The Hwabong soils have less than 35 percent fine gravel and are formed in very deep alluvium on alluvial plain levees subject to flooding except where dyked. The Hwangryong soils contain large size gravel and cobble and occur chiefly on alluvial plains subject to flooding except where dyked. The Iweon soils have cambic B horizons, coarse loamy textures and contain cobbles and stones. The Jungdong soils have coarse loamy textures, contain no gravel and are formed on alluvial plains subject to flooding except where dyked. The Sangju soils have coarse loamy textures and cambic B horizons.

Setting: The Ibseog soils occur on gently sloping to sloping mountain and hill foot slopes and alluvial fans above the flood plains. They are formed in alluvial-colluvial and alluvial materials derived from coarse textured granitic soils. Dominant slopes are 2 to 7 percent and slope ranges from 2 to 15 percent.

Principal Associated Soils: In addition to the competing Sangju, Togye and Iweon soils, these include the Andong and Samgag series. The Andong soils are in the sandy texture family and occur in residual granitic materials associated in upland positions. The Samgag soils have coarse loamy textures and occur in residual granitic materials above the Ibseog soils.

Drainage and Permeability: Excessively drained. Permeability is rapid or very rapid. Runoff is probably slow because of rapid permeability.

Use and Vegetation: Most areas are used for upland crops such as soybean, tobacco, potato, red bean, Indian millet, sesame and similar crops. A few areas are used for paddy rice where streams can be diverted through the paddies.

Distribution and Extent: The Ibseog soils are of small extent and are distributed mostly in the east central parts of the country where coarse grained granitic materials occur.

Series Established: Sangju Gun, Gyeongsangbug Do, 1968.

Ibseog Series Contd.

Lab. Nos. Nd1-3 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	Ap	33.9	10.6	20.0	24.6	18.7	7.4	15.5	2.2	LCoS	58.6	31.3	7.9	LCoS
10- 30	C1	41.9	14.2	26.8	26.8	15.0	6.5	9.5	1.2	S	70.6	24.5	3.7	S
30-120	C2	48.1	8.1	26.8	24.8	14.7	7.5	17.4	0.7	LCoS	62.5	34.2	2.6	S

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
			6.0	4.7	1.17	4.95	3.00	0.70	0.00	0.35	-	81.8	-
			6.7	4.5	0.32	4.10	2.75	0.75	0.08	0.12	-	74.9	-
			7.1	4.6	0.22	4.40	3.25	1.12	0.00	0.10	-	101.6	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KDH, JFD
22 October, 1969

IHYEON SERIES

The Ihyeon series is a member of the coarse silty, mixed, mesic family of Dystric Fluventic Eutrochrepts (Alluvial soils). These soils have moderately thick brown to dark brown silt loam A horizons and deep dark yellowish brown to brown silt loam cambic B horizons. C horizons are very deep brown weakly stratified silt loam. These soils are in slightly elevated portions of continental alluvial plains.

Typifying Pedon: Ihyeon silt loam - barley (Field description Gimhae Gun profile No. 69; colors are for moist soil.)

Ap1 -- 0 to 11 cm. Brown to dark brown (10YR 4/3) silt loam; common fine distinct strong brown (7.5YR 5/8) mottles; weak and moderate fine granular structure; friable, slightly sticky and slightly plastic; common fine mica; common fine barley roots; abrupt smooth boundary; pH 5.5.

Ap2 -- 11 to 20 cm. Brown to dark brown (10YR 4/3) silt loam; common fine faint dark yellowish brown (10YR 4/4) mottles; weak medium platy structure; firm, slightly sticky and slightly plastic; common fine mica; few fine vertical and oblique tubular pores; common fine rice roots; clear smooth boundary; pH 5.0.

B -- 20 to 80 cm. Dark yellowish brown to yellowish brown (10YR 4/4 to 5/4) silt loam; weak coarse subangular blocky structure, breaking to moderate and fine granular; firm, slightly sticky and slightly plastic; few fine worm holes and casts; many fine random tubular pores; common fine mica; few fine barley roots; clear smooth boundary; pH 5.5.

C1 -- 80 to 110 cm. Dark yellowish brown (10YR 4/4 to 3/4); weakly stratified silt loam and very fine sandy loam; structureless (massive); friable, slightly sticky and slightly plastic; common fine mica; few fine vesicular pores; pH 6.0.

C2 -- 110 to 140 cm. Dark yellowish brown (10YR 3.5/4) silt loam; weakly stratified; common fine yellow and white mica.

Type Location: Gimhae Gun, Gyeongsangnam Do, near Sisan village, Sisan Ri, Leebug Myeon.

Range in Characteristics: Solum thickness is commonly more than 100 cm. over contrasting strata. Depth over hard rock is probably more than 5 meters. Reaction is strongly acid to slightly acid increasing somewhat with depth. Few to common fine mica occur. The organic matter content ranges chiefly between 0.5 and 2.5 percent, being highest in the A horizon. Ap horizons are 20 to 30 cm. thick, brown to dark brown or dark yellowish brown. When in irrigated rice paddy Apg horizons are dark grayish brown to grayish brown mainly silt loam ranging to light silty clay loam or very fine sandy loam. The cambic B horizons, 80 to 125 cm. thick, are brown to dark brown or dark yellowish brown silt loam, loam or silt with less than 18 percent clay, weak blocky structure and more yellow colors and less organic matter than the A horizons. Thin strata of fine loamy or fine silty textures may occur. C1 horizons are dark yellowish brown or brown stratified silt loam, fine sandy loam, loam or silt. Typically, gray mottles and other evidence of fluctuating ground water occur below 125 cm. depths though they may range to 100 cm. Few brown or dark brown soft concretions and mottles are characteristic.

Competing Series and Their Differentiae: These include the Gyuam, Bonryang and Nagdong series. The Gyuam soils are moderately well drained, have gray mottles and fluctuating ground water tables between 50 and 100 cm. The Bonryang soils have coarse loamy sola and sandy substrata. The Nagdong soils have sandy textures throughout and are well drained.

Setting: Level to nearly level slightly dissected broad continental alluvial plains mainly in levee positions on the concave side of river bends. Slopes ranges from 0 to 2 percent.

Principal Associated Soils: These are the Nagdong, Gyuam, Bonryang and Hwabong soils. The Hwabong soils have sandy textures. The Jungdong soils have coarse loamy textures.

Drainage and Permeability: Well drained. Runoff is slow and permeability is probably moderately slow.

Use and Vegetation: These soils are used chiefly for leafy vegetables, barley, peanuts and similar crops. Paddy rice is sometimes grown where irrigation water is abundant.

Distribution and Extent: The Ihyeon soils occur in the major river valleys throughout the country mostly in wide alluvial plains.

Series Established: Ihyeon Dong, Daegu City, Gyeongsangbug Do, June 15, 1967.

Remarks: The reaction and base saturation are somewhat higher in areas influenced by shale and limestone geology.

Lab. Nos. G189-93 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 11	Ap1	0.0	———	0.7	———	0.9	7.1	73.8	17.5	SiL	0.9	29.5	52.1	SiCL
11- 20	Ap2	0.5	———	0.7	———	1.1	7.2	72.8	18.8	SiL	1.0	31.3	48.9	SiCL
20- 80	B	2.1	———	0.6	———	1.1	8.8	70.5	19.0	SiL	0.9	33.3	46.8	SiCL
80-110	C1	0.0	———	0.8	———	4.2	24.2	57.5	13.3	SiL	1.0	57.4	28.3	L
110-140	C2	0.4	———	0.5	———	1.5	12.9	68.6	16.5	SiL	0.7	41.4	41.4	CL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H₂O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H
46.5	38.3	13.0	5.3	4.0	1.43	170	10.00	7.60	2.45	0.23	0.23	0.48
43.9	37.6	14.4	5.7	3.8	1.08	81	11.70	7.75	2.40	0.28	0.18	0.43
40.7	34.2	13.7	6.2	3.9	0.72	16	11.70	9.00	2.55	0.25	0.15	0.19
37.5	27.8	9.4	6.0	4.0	0.56	16	9.40	8.40	2.60	0.18	0.10	0.12
38.8	33.1	11.3	6.0	4.0	0.67	16	10.60	9.35	3.35	0.18	0.13	0.12

Base Saturation %: CEC	Sum of Cations
105.1	95.6
90.7	96.1
102.1	98.4
120.0	98.9
122.7	99.1

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
11 November, 1969

IMDONG SERIES

The Imdong series is a member of the coarse loamy, mixed, mesic family of Dystric Fluventic Eutrochrepts (Alluvial soils). These soils have thin dark reddish brown gravelly loam A horizons and moderately deep reddish brown gravelly sandy loam cambic B horizons. C horizons are very deep reddish brown gravelly sandy loam increasing in gravel content with depth. The Imdong series occurs in local alluvial positions and is formed in materials washed from reddish brown shale and sandstone soils.

Typifying Pedon: Imdong gravelly loam - barley (Field description Imha Reservoir Survey profile No. 2; colors are for moist soil.)

Ap -- 0 to 10 cm. Dark reddish brown (5YR 3/4) gravelly loam; moderate fine to medium granular structure; friable, slightly sticky and slightly plastic; approximately 20 percent weathered reddish brown fine shale gravel; few fine roots; abrupt smooth boundary.

B1 -- 10 to 30 cm. Dark reddish brown (2.5YR 3/4) gravelly sandy loam; weak medium subangular blocky structure, easily breaking to moderate fine granular; friable, slightly sticky and slightly plastic; approximately 30 percent fine gravel as above; few fine pores, few very fine roots; abrupt smooth boundary.

B2 -- 30 to 70 cm. Reddish brown (5YR 5/4) fine gravelly sandy loam; weak coarse subangular blocky structure; firm, slightly sticky and slightly plastic; approximately 20 percent gravel as above; few fine pores; very few fine roots; gradual wavy boundary.

C -- 70 to 120 cm. Brown (7.5YR 4/4) gravelly sandy loam; structureless (massive) breaking to weak blocky and coarse granular; firm, slightly sticky and slightly plastic; about 40 percent gravel as above; common fine pores; no roots.

Type Location: Andong Gun, Gyeongsangnam Do, about 200 meters west of Maryeong Dong, Imdong Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is probably more than 3 meters. Base saturation is more than 60 percent. Reaction is strongly to slightly acid. The solum contains from 10 to 35 percent slightly weathered reddish brown shale gravel, with some sandstone pieces. Clay content is less than 18 percent. Ap horizons, 10 to 25 cm. thick, are dark reddish brown, reddish brown or brown to dark brown gravelly loam, fine sandy loam, sandy loam or silt loam. Cambic B horizons are reddish brown, dark reddish brown, weak red or dusky red gravelly fine sandy loam, sandy loam, loam or silt loam. C horizons are brown, light reddish brown, reddish brown or weak red, weakly stratified gravelly sandy loam, loam or silt loam.

Competing Series and Their Differentiae: These include the Mui, Sangju, Seongsan, Banho, Iweon, Seogto, Hogye, Anyong, Maryeong, Gaghwa and Weondang series. The Banho soils have fine loamy textures and are derived from gray shale materials. The Mui soils have dark colored A horizons high in organic matter and are in high mountain colluvium. The Sangju soils have yellowish brown B horizons and occur in granitic areas. The Seongsan soils have yellowish red B horizons and occur in granitic areas. The Iweon soils contain larger coarse fragments, occur in slightly dissected deep mountain colluvium and are derived from coarse grained granitic materials. The Seogto soils have loamy skeletal textures and are derived from fine grained acidic crystalline materials. The Hogye soils have loamy skeletal textures and dark colored surfaces. The Anyong and Gaghwa soils have argillic B horizons and fine textures. The Maryeong soils contain gray mottles between 50 and 100 cm. and are moderately well drained. The Weondang soils have fine loamy textures, contain mica and are associated with granitic soils.

Setting: The Imdong soils are on gently sloping to moderately steep foot slopes, alluvial slopes and alluvial fans in materials locally washed from the reddish brown shale and sandstone soils. Dominant slopes are 2 to 15 percent and range from 2 to 30 percent.

Principal Associated Soils: The Habin and Buyeo soils are associated in residual upland positions. The Samam and Maryeong soil are associated in local valleys and narrow alluvial plains at lower elevations.

Drainage and Permeability: Well drained. Permeability is probably moderate, and runoff is medium.

Use and Vegetation: Mostly cleared and used for general upland crops including tobacco, barley, soybean, red pepper, Indian millet and buck wheat. A small amount is used for paddy rice.

Distribution and Extent: The Imdong soils are of small extent and are distributed in central and southeastern parts of the country where reddish shale and sandstone areas occur.

Series Established: Andong Gun, Gyeongsangbug Do, 1969.

Imdong Series Contd.

Lab. Nos. Nd12-14 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay >.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0-10	Ap	22.1	5.9	7.7	12.1	3.5	19.2	44.5	7.1	L	27.9	41.2	23.8	SL
10-30	B1	43.2	11.1	10.1	13.6	14.8	8.6	32.6	10.2	SL	37.0	38.7	15.1	SL
30-70	B2	29.9	8.3	11.3	13.1	12.4	7.5	35.3	12.1	SL	34.5	34.9	18.5	SL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
			5.7	4.5	1.52	6.20	5.00	1.25	0.12	0.27	-	107.1	-
			5.4	4.1	0.79	5.10	4.38	0.75	0.17	0.17	-	107.2	-
			6.3	4.8	0.83	7.80	7.62	1.25	0.12	0.15	-	117.2	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
HSY, KBJ, UKT, JFD
7 November, 1969

IMOG SERIES

The Imog series is a member of the coarse loamy, mixed, mesic family of Fluventic Hapludolls (Alluvial soils). These soils have moderately thick very dark brown sandy loam A horizons and deep dark yellowish brown sandy loam weakly stratified cambic B horizons. The C horizons are stratified brown fine gravelly sandy loam. The Imog series developed in local alluvial-colluvial materials in narrow local valleys, on local alluvial fans and low terraces derived from coarse textured mostly granitic and similar materials.

Typifying Pedon: Imog sandy loam - potatoes (Field description Pyeongchang Gun profile No. 121; colors are for moist soil.)

A1p -- 0 to 9 cm. Dark brown (10YR 3/3) coarse sandy loam; weak, fine and medium granular structure; friable, nonsticky and nonplastic; many medium and coarse interstitial pores; about 10 percent quartz grit and fine gravel; few fine yellow mica flakes; few fine and medium roots; abrupt smooth boundary; pH 6.0.

A12 -- 9 to 46 cm. Dark brown (10YR 3/3) coarse sandy loam; weak, medium and coarse subangular blocky breaking readily to moderate coarse granular structure; friable, nonsticky and nonplastic; angular quartz grit, gravel and mica as above; few fine and medium roots; clear smooth boundary; pH 6.0.

Ab -- 46 to 79 cm. Black (10YR 2/1) coarse sandy loam; weak medium and coarse subangular blocky and moderate granular structure; common fine and medium discontinuous simple tubular pores; few large worm casts; slightly more quartz grit; common very fine and fine yellowish mica; clear smooth boundary; pH 6.0.

Bb -- 79 to 90 cm. Dark yellowish brown (10YR 4/4) loamy coarse sand; structureless (massive) breaking to weak medium and coarse granular; firm, nonsticky and nonplastic; common fine and medium pores; about 15 percent slightly weathered fine quartz grit and granitic gravel; mica as above; gradual smooth boundary; pH 6.0.

B2b -- 90 to 120 cm. Very dark brown (10YR 2/2) coarse sandy loam; structureless (massive) breaking to weak medium and coarse granular; firm, slightly sticky and nonplastic; common fine and medium to coarse discontinuous simple tubular pores; few worm holes and some worm casts; quartz grit and gravel as above; mica as above; pH 6.0.

Type Location: Pyeongchang Gun, Gangweon Do, about 50 meters north of Gucheon Ri, Doam Myeon.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. and depth to hard rock is more than 3 meters. Reaction is strongly to slightly acid and base saturation is 60 percent or more. Fine quartz grit is less than 10 percent and few or common fine mica flakes are present throughout. A horizons, 20 to 30 cm. thick, are dark brown, very dark brown, very dark grayish brown or black sandy loam to coarse sandy loam generally with more than 2 percent organic matter. The cambic B horizons are dark yellowish brown, brown or dark brown fine gravelly sandy loam, coarse sandy loam or coarse loam with no more than weakly developed subangular blocky structure. C horizons are variable. Centered on dark yellowish brown, they range from yellowish brown to very dark brown stratified gravelly sandy loam to coarse sand or sand. Bisequal profiles may occur in which A horizons appear as strata and the soil depth is somewhat more than normal.

Competing Series and Their Differentiae: Closely related or similar series are the Sangju, Seongsan, Iweon, Hogye and Maji soils. The Sangju soils lack a mollic epipedon. The Seongsan soils have lighter surface colors and yellowish red subsoil colors. The Iweon soils have yellower colors and stony or bouldery sandy loam textures. The Hogye soils belong to the loamy skeletal texture family. The Maji soils have loamy skeletal textures, near neutral reaction and limestone source materials.

Setting: The Imog soils are formed in local alluvial-colluvial deposits in narrow valleys, alluvial fans, and local low terraces in coarse loamy materials derived from granitic and similar soils. The climate is cool and moist with a growing season of about 170-180 days. Dominant slopes are 2 to 7 percent and the range is from 2 to 15 percent.

Principal Associated Soils: These are the Odae, Weoljeong, Bonryang and Hogye series. The shallow Odae and deep Weoljeong are residual soils associated in adjacent uplands. The Bonryang soils are associated on alluvial plains. The Hogye soils are associated in similar physiographic positions.

Drainage and Permeability: Well drained. Permeability is probably moderate. Surface runoff is slow to medium.

Use and Vegetation: Most of these soils are used for corn, barley, soybeans, radish, potatoes and similar upland crops. Only a small amount is planted to paddy rice.

Distribution and Extent: The Imog series is of small extent in valleys at high elevations mostly in the northeastern part of the country.

Series Established: Pyeongchang Gun, November 1968.

Lab. Nos. Mh285-289 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 9	A1p	8.8	14.5	18.1	19.5	9.9	10.4	18.9	8.9	CoSL	55.0	22.9	13.2	CoSL
9- 46	A12	12.1	13.0	17.8	19.1	14.7	6.6	19.2	9.6	CoSL	52.6	25.0	12.8	CoSL
46- 79	Ab	12.8	18.3	22.2	15.2	9.5	5.3	19.5	10.0	CoSL	57.4	18.5	14.1	CoSL
79- 90	Bb	13.9	15.7	18.5	12.6	4.4	10.7	24.4	13.7	CoSL	48.4	18.6	19.1	CoSL
90-120	B2b	10.6	15.6	17.3	15.2	9.8	5.1	24.2	12.8	CoSL	50.0	19.4	17.8	CoSL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations Ca me/100g	Mg	Na	K	H
28.5	21.5	7.0	5.5	4.1	4.61	316	7.00	3.30	0.70	0.05	0.48	0.50
24.9	18.9	6.9	5.4	3.9	2.87	97	4.95	2.35	0.35	0.03	0.10	1.16
35.0	25.6	9.1	6.0	4.5	5.03	24	11.85	6.70	0.65	0.05	0.10	0.15
36.7	27.7	9.1	6.0	4.4	3.89	17	8.70	6.25	0.85	0.05	0.10	0.15
31.6	25.0	7.9	6.0	4.3	2.25	17	7.05	4.35	0.85	0.05	0.15	0.20

Base Saturation % CEC	Sum of Cations
64.7	98.9
57.2	70.9
63.3	98.0
83.3	98.0
76.6	96.4

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
11 November, 1969

IWEON SERIES

The Iweon series is a member of the coarse loamy, mixed, mesic family of Typic Dystrochrepts (Regosols). These soils have moderately thick brown to dark brown stony sandy loam A horizons and moderately deep strong brown gravelly and stony sandy loam cambic B horizons. C horizons are very deep brownish yellow gravelly and stony sandy loam. They are developed in stony coarse loamy mountain alluvial-colluvial materials mostly on slightly dissected fan deposits derived from granitic soils.

Typifying Pedon: Iweon stony sandy loam - forest (Field description Ulju Gun profile No. 21; colors are for moist soil.)

A1 -- 0 to 12 cm. Brown (10YR 5/3), pale brown (10YR 6/3) dry, stony sandy loam; moderate very fine to medium granular structure; friable, slightly sticky and nonplastic; approximately 30 percent slightly weathered granitic medium gravel and stones; many fine and medium living pine tree, wild grass and shrub roots; clear wavy boundary; pH 4.5.

A3 -- 12 to 27 cm. Light yellowish brown (10YR 6/4) stony sandy loam; moderate fine and medium granular structure; friable, slightly sticky and slightly plastic; common fine and very fine pores; approximately 10 percent slightly weathered subangular granite stones; roots as above; clear wavy boundary; pH 4.5.

B1 -- 27 to 56 cm. Strong brown (7.5YR 5/8) stony sandy loam; weak fine and medium subangular blocky structure breaking to moderate fine and medium granular; firm, slightly sticky and slightly plastic; common fine and medium pores; approximately 30 percent stones as above; common fine and medium living pine tree and shrub roots; clear wavy boundary; pH 5.0.

B2 -- 56 to 81 cm. Strong brown (7.5YR 5/6) stony sandy loam; moderate medium and fine subangular blocky structure; firm, slightly sticky and slightly plastic; stones as above; few fine and medium living pine tree roots; diffuse smooth boundary; pH 4.7.

C -- 81 to 110 cm. Brownish yellow (10YR 6/8) stony loam; structureless (massive); firm in place, friable in hand, slightly sticky and slightly plastic; many pores as above; approximately 10 percent stone and gravel as above; very few medium living fine tree roots; pH 5.0; weakly stratified alluvial-colluvial deposit.

Type Location: Weolseong Gun, Gyeongsangbug Do, about 500 meters east of Gueo Ri, Oedong Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is generally 3 to 10 meters. Base saturation of the solum ranges from 35 to 60 percent and increases somewhat with depth. Reaction is medium to slightly acid. 10 to 30 percent slightly weathered subangular granite stones, gravel, and cobbles occur throughout the soil. The coarse fragments tend to increase in size and volume with depth. A horizons are brown, dark brown or dark yellowish brown, yellowish brown where eroded, stony sandy loam or coarse loam. Cambic B horizons are strong brown, yellowish brown, dark yellowish brown, light yellowish brown, brownish yellow or reddish yellow stony sandy loam or loam with weak blocky structure partly breaking to granular. The C horizons are weakly stratified and unconsolidated brownish yellow, light yellowish brown or dark yellowish brown gravelly, cobbly, stony and some bouldery loam, sandy loam, or light sandy clay loam with granular structure.

Competing Series and Their Differentiae: These include the Seongsan, Sangju, Imdong, Togye, Ibseog and Weondang soils formed in local alluvial-colluvial materials and the Gaghwa, Ungyeo and Mui soils formed mountain colluvium. The Seongsan soils have redder B horizons and are free of coarse fragments. The Sangju soils are free of coarse fragments. The Imdong soils have reddish brown colors and mixed shale and sandstone parent materials. Weondang soils have fine loamy textures and red or yellowish red colors. The Togye and Ibseog soils have sandy textures and contain fine gravel throughout. The Gaghwa soils have fine clayey textures and argillic B horizons. The Ungyo soils have fine clayey textures, argillic B horizons and dark colored A horizons. The Mui soils have darker A horizons.

Setting: Iweon soils occur on dissected mountain foot slopes, deep fan terraces and mountain alluvial-colluvial materials derived chiefly from coarse loamy and stony granitic soils. Dominant slopes are 2 to 15 percent ranging from 2 to 30 percent.

Principal Associated Soils: In narrow local valleys, the Sachon, Yongji, Tongcheon, Sindab and Jisan soils are associated in alluvial positions. Associated in residual positions on mountain slopes, the Samgag, Gwanag and similar soils are the source materials of the Iweon soils.

Drainage and Permeability: Well drained. Permeability is moderate. Runoff is medium.

Use and Vegetation: Most of the Iweon soils are in upland crops such as tobacco, radish, sesame, soybean, sweet potato, barley and vegetables. Some of the more stony and sloping areas are in pine and mixed forest.

Distribution and Extent: The Iweon soils are of moderate extent and are distributed in dissected mountain foot slopes, throughout the granitic areas of the country.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966.

Lab. Nos. U147-151 Typifying Peeon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 12	A1	22.2	5.6	8.8	11.0	13.0	6.6	47.9	7.2	SL	28.5	24.7	39.1	L
12- 27	A3	14.6	5.4	8.4	11.4	13.7	6.6	47.7	8.0	L	27.2	29.7	35.1	L
27- 56	B1	32.7	5.7	10.8	14.4	14.5	6.0	41.9	6.7	SL	34.6	26.3	32.4	L
56- 81	B2	25.8	5.2	10.7	16.6	18.6	7.3	35.5	6.1	SL	37.4	27.3	29.2	SL
81-110	C	4.7	1.5	5.1	10.3	16.0	8.6	47.6	10.9	L	20.2	32.2	36.7	L

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	S.G.	Atterberg Limits %: LL	PI	pH: H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm
	23.9	8.0	2.60	29.0	6.0	5.1	3.6	2.20	11
	24.0	8.0	2.62	-	-	5.1	3.6	1.40	7
	21.5	7.3	2.65	28.0	7.0	5.2	3.6	0.60	-
	18.5	6.3	2.65	-	-	5.4	3.6	0.30	-
	25.8	9.5	2.67	30.0	8.0	5.6	3.6	0.20	-

2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations	Elemental Analysis of Clay: SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %
3.40	0.65	0.45	0.05	0.13	-	37.6	-	2.80	58.55	7.55	30.61
3.00	0.20	0.25	0.09	0.08	-	20.7	-	2.84	58.41	7.36	30.26
3.80	0.15	0.60	0.16	0.05	-	25.3	-	2.61	56.83	7.27	32.14
5.30	0.40	1.45	0.06	0.08	-	37.5	-	2.66	57.81	7.25	32.28
9.10	0.75	2.85	0.23	0.05	-	42.6	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KPJ, JFD
16 May, 1969

JANGSEONG SERIES

The Jangseong series is a member of the fine loamy, mixed, nonacid, mesic family of Lithic Udorthents (Lithosols). These soils have moderately thick dark brown channery silt loam A horizons over hard limestone bedrock. They are developed in residuum from limestone in hilly to very steep mountainous areas.

Typifying Pedon: Jangseong rocky silt loam - pine forest. (Field description Pyeongchang Gun profile No. 36; colors are for moist soil.)

A11 -- 0 to 11 cm. Dark brown (7.5YR 4/2) channery silt loam; moderate or strong fine to medium granular structure; friable, slightly sticky and plastic; many fine to medium grass and pine tree roots; about 20 percent rock outcrops in the area; gradual smooth boundary; pH 8.0.

A12 -- 11 to 37 cm. Dark brown (7.5YR 4/4) channery silt loam; weak and moderate fine to medium granular structure; friable, slightly sticky and slightly plastic; about 30 percent slightly to strongly weathered limestone fragments and stones; common roots as above; abrupt wavy boundary; pH 8.0.

R -- 37 cm. Unweathered hard limestone bedrock.

Type Location: Pyeongchang Gun, Gangweon Do, 4 km. north Danjin Bridge, Danjin Ri, Pyeongchang Myeon.

Range in Characteristics: Soil depth ranges from 20 to 50 cm. over hard bedrock. Base saturation is more than 60 percent. Reaction is neutral to mildly alkaline. 10 to 35 percent slightly to strongly weathered limestone fragments occur throughout the soil profiles. Rock outcrops range from none to 90 percent. A horizons are mainly dark brown, brown, dark reddish brown or reddish brown channery silt loam, loam, silty clay loam or clay loam. The bedrock is hard limestone.

Competing Series and Their Differentiae: These include the Habin, Daegu, Jeongja, and Mudeung series. The Habin soils have coarse loamy textures, reddish brown colors, and are developed from red shale and sandstone materials. The Daegu soils have fine loamy textures and are developed from gray shale materials. The Jeongja soils have fine loamy textures, dark reddish brown colors and are developed from dark colored basic igneous crystalline rocks. The Mudeung soils have more acid reaction, lower base saturation and are formed over andesite porphyry parent materials.

Setting: The Jangseong soils are in steep mountainous areas and are formed from residual limestone rock materials. Dominant slopes are 30 to 60 percent range is from 7 to 100 percent.

Principal Associated Soils: The red fine clayey Pyeongchang soils are formed on lower mountain slopes where deeper weathering and less geologic erosion occurs. The Pyeongan soils are formed in mountain colluvium below the Jangseong soils. The Cheongsim soils are associated in adjacent gray shale areas.

Drainage and Permeability: Somewhat excessively drained. Permeability is moderate and runoff is rapid to very rapid after soil saturation.

Use and Vegetation: Most areas are used for pine and mixed forest but some areas are cultivated for sweet potato, corn, tobacco and vegetables.

Distribution and Extent: The Jangseong soils are of moderate extent in the mountainous limestone areas of the country.

Series Established: Gwangsan Gun, Jeollanam Do, 1966

Lab. Nos. Mh105-106 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0-11	A11	23.6	5.1	3.4	3.3	5.6	7.2	53.3	22.1	SiL	12.5	26.3	39.1	CL
11-37	A12	38.8	4.9	3.1	3.3	5.8	7.2	52.9	22.8	SiL	12.0	26.0	39.2	CL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H2O (1:1)	pH 1 N KCl	O.M. %	2/ CEC (me/100g)	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	33.9	14.8	1.03	7.7	7.0	6.06	25.58	20.10	6.70	0.20	0.30	0.05	106.7	99.8
	30.8	13.3	-	7.9	6.7	3.85	22.80	17.90	6.80	0.28	0.22	0.05	110.5	99.8

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
7 November, 1969

JANGWEON SERIES

The Jangweon series is a member of the fine loamy mixed, mesic family of Typic Fragiochrepts (planosols). These soils have thin brown gravelly loam A horizons and thick yellowish brown gravelly silty clay loam horizons over moderately thick or thick mottled pale brown, strong brown and yellowish brown gravelly silty clay loam fragipan horizons. C horizons have mixed brown colors, stratified gravelly fine loamy textures and are formed in dissected footslope positions in materials derived from fine grained granite, porphyry and shale upland soils.

Typifying Pedon: Jangweon gravelly loam - forest (Field description Dalseong Gun profile No. 108; colors are for moist soil.)

A -- 0 to 15 cm. Dark yellowish brown (10YR 4/4) gravelly loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; about 10 percent slightly weathered porphyry gravel; many fine grass roots; gradual smooth boundary.

B1 -- 15 to 50 cm. Yellowish brown (10YR 5/6) gravelly loam; weak fine to medium subangular blocky structure; firm, sticky andplastic; common medium black (Mn) mottles on ped faces; gravel as above; common fine roots; common fine and medium pores; clear smooth boundary.

B21x -- 50 to 65 cm. Yellowish brown (10YR 5/6) gravelly clay loam; moderate very coarse prismatic structure breaking to strong medium platy and moderate fine and medium subangular blocky; very firm, sticky and plastic; about 20 percent gravel as above; common fine to medium prominent black (Mn) inped mottles; thick continuous light brownish gray exprism cutans; common fine vesicular pores; clear smooth boundary.

B22x -- 65 to 150 cm. Strong brown (7.5YR 5/6) cobbly clay loam; common medium distinct yellowish brown (10YR 5/8), pale brown (10YR 6/3) and dark reddish brown (5YR 3/4) mottles; moderate very coarse prismatic structure breaking to strong medium platy and moderate medium blocky; very firm, sticky and plastic; few fine inped and exped Mn mottles; medium continuous grayish brown exprism cutans decreasing with depth. Source materials are both andesite porphyry and gray shale.

Type Location: Dalseong Gun, Gyeongsangbug Do, about 500 meters south of Daeil Dong, Gachang Myeon.

Range in Characteristics: Solum thickness is 100 to 125 cm. and depth to hard rock is generally more than 3 meters. The fragipan horizons generally occur between 50 and 100 cm. 10 to 30 percent slightly weathered gravel, cobbles and stones commonly occur throughout the soil. Base saturation is more than 60 percent. Reaction is slightly acid and increases somewhat with depth. A horizons are 10 to 20 cm. thick, yellowish brown, dark yellowish brown, pale brown or brown slightly gravelly, gravelly or cobbly silt loam, silty clay loam or loam. The B1 horizons above the fragipan are about 25 to 50 cm. thick, yellowish brown, dark yellowish brown, st. brown light yellowish brown or reddish brown gravelly, cobbly or stony clay loam, silt loam, loam or silty clay loam. Bx horizons 25 to 100 cm. thick, are very firm or extremely firm when dry and do not soften appreciably when moist. They are dark yellowish brown, pale brown, strong brown or brown slightly or gravelly silt loam, loam, silty clay loam or clay loam with coarse prismatic structure breaking to moderate or strong platy. Few or common grayish brown, light grayish brown or gray mottles with 10YR or 2.5Y hues commonly occur in the Bx and C horizons. The C horizons are variably colored yellowish brown, strong brown, dark yellowiwh brown, yellowish red or light grayish brown weakly stratified gravelly, cobbly or stony silt loam, silty clay loam, loam or clay loam abruptly overlying residuum.

Competing Series and Their Differentiae: These include the moderately well drained Jangyu, Gongseong, Hwadong, Hagsan and the well drained Banho, Anyong, Gaghwa and Seogto series with no fragipan horizons. The Jangyu soils have loamy skeletal textures and occur on dissected fan terraces. The Gongseong and Hwadong soils have fine clayey textures and occur on stream terraces. The Hagsan soils have fine loamy over sandy textures and occur on stream terraces. The Banho series is more friable and is formed in local alluvium derived from grayish brown shale soils. The Anyong soils have argillic Bt horizons. The Gaghwa soils have fine clay textures, yellowish red colors and argillic Bt horizons. The Seogto soils have loamy skeletal textures.

Setting: The Jangweon soils occur on gently sloping to moderately steep alluvial-colluvial footslopes and alluvial fans in weakly stratified gravelly, cobbly and some stony fine loamy materials washed from residual upland soils in areas of granite, andesite porphyry and grayish brown shale. Dominant slopes are 7 to 30 percent and range is from 2 to 60 percent.

Principal Associated Soils: The Mudeung, Taehwa, Ulsan, Daegu, Dalcheon, Samgag and similar soils are associated in higher residual landscape positions. The Anyong, Gaghwa and Iweon soils may be associated in similar landscape positions. The Gongseong, Hwadong and Bancheon are associated in terrace positions and the Jisan and Sangju soils may be associated below the Jangweon soils.

Drainage and Permeability: The Jangweon soils are moderately well drained and very slowly permeable. The runoff is moderate or rapid depending on the slope.

Use and Vegetation: Most areas in central and southern parts of the country produce fuelwood forest and wild grass. Some areas are used for tobacco, barley, soybean, sesame, melon, millet, red pepper, buckwheat and similar nonirrigated upland crops.

Established Series
UKT, JFD
6 November, 1969

JANGYU SERIES

The Jangyu series is a member of loamy skeletal, mixed, mesic family of Aquic Eutrochrepts (Alluvial-Red-Yellow Podzolic soils with high base saturation). These soils have dark grayish brown clay loam Apg horizons and moderately deep strong brown very gravelly silty clay loam cambic B horizons with gray mottles. The C horizons are very deep strong brown very gravelly to very cobbly loam with gray mottles. They are developed on slightly dissected river terraces and alluvial fans in weakly stratified gravelly and cobbly fine loamy materials derived from granitic, andesite porphyry or gray shale materials.

Typifying Pedon: Jangyu clay loam - paddy rice (Field description Gimhae Gun profile No. 153; colors are for moist soil.)

Ap1g -- 0 to 11 cm. Dark grayish brown (2.5Y 4/2) clay loam; common fine distinct yellowish brown (10YR 5/8) mottles; moderate medium and fine granular structure; slightly firm, sticky and plastic; many fine rice roots; abrupt smooth boundary; pH 6.0.

Ap2g -- 11 to 30 cm. Dark grayish brown (2.5Y 4/2) clay loam; many fine prominent red (2.5YR 5/8) mottles; weak coarse platy structure in upper part breaking to moderate medium and coarse subangular blocky; firm, sticky and plastic; few fine rice roots; clear smooth boundary; pH 6.0.

B21 -- 30 to 47 cm. Grayish brown (10YR 5/2) gravelly clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; moderate coarse prismatic structure breaking to moderate medium subangular blocky; firm, sticky and plastic; continuous thin gray (10YR 5/1) exprism cutans; approximately 25 percent fine strongly weathered granitic gravel; clear smooth boundary; pH 6.5.

B22 -- 47 to 68 cm. Strong brown (7.5YR 5/8) very gravelly clay loam; common prominent grayish brown (10YR 5/2) and dark reddish brown (5YR 3/1) mottles; crushed color yellowish brown (10YR 5/6); weak coarse prismatic structure breaking to weak coarse subangular blocky; firm, slightly sticky and slightly plastic; discontinuous thin grayish brown (10YR 5/2) cutans; approximately 40 percent gravel as above; pH 6.5.

C -- 68 to 120 cm. As above except for about 70 percent gravel; pH 6.5.

Type Location: Gimhae Gun, Gyeongsangnam Do, about 150 meters north of Chojung Ri, Jinlae Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. Depth to hard rock is generally more than 4 meters. Most areas have 35 to 90 percent slightly weathered hard round gravel and cobbles below about 50 cm. Base saturation is more than 60 percent. Reaction is slightly acid in the solum and increases somewhat with depth. Apg horizons are dark grayish brown clay loam, silty clay loam, silt loam or heavy loam with few gravel pieces. Most larger pieces have been removed by farmers. Cambic B horizons are strong brown, brown or yellowish brown, very gravelly clay loam, very gravelly sandy clay loam or very gravelly silty clay loam with many medium and fine prominent or distinct gray, grayish brown, dark grayish brown or olive gray mottles. C horizons are very deep, mottled strong brown, dark reddish brown, grayish brown, yellowish brown and grey weakly stratified very gravelly and or very cobbly loam, silt loam, silty clay loam, clay loam and or sandy loam.

Competing Series and Their Differentiae: These are the Bancheon, Hwadong, Banggi, Hoggye, Anyong and Hwangyeong series. Bancheon soils have fine clayey textures, yellowish red colors and are free of gravel. The Hwadong soils have fine clayey textures, gray mottles in the lower Bt and C horizons and are gravel free. The Banggi soils have yellowish red colors and clayey skeletal textures. The Hogye soils have loamy skeletal textures, thick dark brown A horizons and are well drained. The Anyong soils have loamy skeletal textures, lack gray mottles and are formed on dissected mountain alluvial-colluvial fans. The Hwangyeong soils have sandy skeletal textures and are excessively drained.

Setting: The Jangyu soils occur on gently sloping slightly dissected low terraces and alluvial fan terraces derived from weakly stratified very gravelly and very cobbly alluvium washed from granitic, rocks, andesite porphyry, shale and some sandstone mountainous areas. Dominant slopes are about 2 to 7 percent and slope range is from 1 to 15 percent.

Principal Associated Soils: The Banggi and Gaghwa soils are associated in slightly higher physiographic positions. The Geugrag, Honam and Hwangyeong soils are associated in lower positions.

Drainage and Permeability: Moderately well drained. Permeability is slow or very slow. Runoff is very slow because essentially all areas have been leveled and dyked for rice paddy land use.

Use and Vegetations: Most of these soils are used for flood irrigated rice during wet summer and nonirrigated barley during dry winter and spring season. Some areas grow pine trees.

Distribution and Extent: The Jangyu soils are of small extent and are distributed in the central and southern parts of the country in association with high mountains and large alluvial fans.

Series Established: Gimhae Gun, Gyeongsangnam Do, 1968.

Remarks: Most of the larger gravel and cobbles were not included in the mechanical analysis. No equivalent series has been established to date with a gravelly solum or with fine clayey textures. The series is placed in the Aquic Eutrochrepts because it is though that the gray colors above the 47-68 cm. layer are artificial and have been produced by use for paddy.

Lab. Nos. G1320-324 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05 .002	Clay <.002	Tex-tural Class	International CS 2-.2	FS .2-.02	Siot .02 .002	Tex-tural Class
0- 11	Ap1g	0.0	2.5	5.0	8.7	6.2	5.2	44.1	28.3	CL	17.2	24.0	30.5	LiC
11- 30	Ap2g	2.9	1.7	4.1	7.7	6.9	4.6	42.4	32.6	CL	14.6	20.9	31.9	LiC
30- 47	B21	25.3	1.5	3.2	5.6	5.1	4.2	47.8	32.6	CL	11.2	22.6	33.6	LiC
47- 68	B22	40.3	5.4	6.3	7.1	2.9	10.4	40.3	27.6	CL	20.1	22.6	29.7	LiC
68-120	C	30.7	6.5	7.5	9.0	8.8	7.1	39.4	21.7	L	24.3	25.7	28.3	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg me/100g	Na	K	H
44.5	37.8	12.1	1.13	4.9	3.9	3.62	12.20	3.45	1.25	0.27	0.30	-
40.0	32.8	13.8	1.43	5.7	4.6	2.59	12.35	4.25	2.25	0.15	0.15	-
43.4	32.0	14.7	-	6.2	5.0	1.24	12.90	5.15	2.60	0.17	0.22	-
39.1	33.3	15.9	-	6.6	5.2	0.79	14.40	6.20	3.70	0.20	0.25	-
37.8	32.9	15.2	-	6.8	5.1	0.34	14.30	7.25	4.50	0.27	0.25	-

Base Saturation % CEC	Sum of Cations
43.2	-
55.1	-
63.1	-
71.9	-
85.8	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
21 November, 1969

JEONBUG SERIES

The Jeonbug series is a member of the fine silty, mixed, nonacid, mesic family of Aeric Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick gray or dark grayish brown silt loam Apg horizons and deep yellowish brown silty clay loam cambic B horizons with common or many gray mottles. Cg horizons are very deep dark gray or dark greenish gray silt loam with few or no mottles. These soils are formed on broad fluvio-marine plains.

Typifying Pedon: Jeonbug silt loam - rice paddy (Field description Gimje Gun profile No. 125; colors are for moist soil.)

Ap1g -- 0 to 10 cm. Dark gray (5Y 4/1) silt loam; puddled, structureless (massive); many fine to medium prominent yellowish brown (10YR 5/8) inmass mottles; friable, slightly sticky and slightly plastic; common fine dendritic pores; common very fine mica; abundant fine to medium dead rice roots; abrupt smooth boundary; pH 5.0.

Ap2g -- 10 to 19 cm. Gray (5Y 5/1) silt loam; weak coarse platy structure; common fine to medium prominent yellowish red (5YR 5/8) and olive brown (2.5Y 4/2) mottles; firm, sticky and plastic; common fine vertical tubular pores; common fine mica; common fine dead rice roots; clear smooth boundary; pH 5.5.

B1g -- 19 to 27 cm. Dark gray (5Y 5/1) silt loam; weak coarse prismatic structure; many fine prominent yellowish red (5YR 5/8) mottles; firm, sticky and plastic; patchy thin cutans; pores and mica as above; few fine dead rice roots; clear smooth boundary; pH 6.0.

B21g -- 27 to 44 cm. Very dark gray (10YR 3/1) silty clay loam; weak coarse prismatic structure breaking to moderate coarse and medium subangular blocky; common fine to medium distinct yellowish brown (10Y 5/8) mottles; firm, sticky and plastic; continuous thin cutans; few fine pores; common fine mica flakes; few fine dead rice roots; abrupt wavy boundary; pH 7.0.

B22 -- 44 to 85 cm. Mottled yellowish brown (10YR 5/8), olive gray (5Y 5/2), and strong brown (7.5YR 5/8) silty clay loam; weak coarse prismatic structure breaking to weak coarse blocky; crushed color olive brown (2.5YR 4/4); firm, sticky and plastic; common fine to medium soft very dark brown (10YR 2/2) Mn mottles; continuous thick very dark grayish brown (10YR 3/2) cutans; many fine to coarse pores; mica as above; roots as above; diffuse smooth boundary; pH 7.0.

B3g -- 85 to 120 cm. Olive gray (5Y 4/2) silt loam; structureless (massive) breaking to weak coarse prismatic; common medium prominent dark yellowish brown (10YR 4/4) mottles; firm, sticky and plastic; continuous thick cutans; common fine to coarse pores; many fine mica flakes; no roots; diffuse smooth boundary; pH 7.0.

C1g -- 120 to 160 cm. Dark gray (5Y 4/1) silt loam; structureless (massive); common fine to medium faint olive gray (5Y 4/2) mottles; sticky and plastic; few fine pores; common fine mica flakes; diffuse smooth boundary; pH 8.0.

C2g -- 160 to 200 cm. Dark greenish gray (10GY 4/1) wet, silt loam; structureless (massive); no mottles; no cutans; sticky and plastic; no pores; many fine mica flakes; no samples taken; pH 8.5.

Type Location: Gimje Gun, Jeollabug Do, about 700 meters southwest of Jinbong Primary School, Sangweol Ri, Jinbong Myeon.

Range in Characteristics: The solum thickness ranges from 75 to 125 cm. and depth to hard rock is probably more than 5 meters. Except for the Apg horizons which range from strongly to medium acid unless limed, reaction is slightly acid to neutral and increases with depth. Common to many fine mica flakes are throughout the profiles. Apg horizons are 20 to 30 cm. thick, dark grayish brown, gray or olive gray silt loam or silty clay loam with many or common yellowish brown, yellowish red, strong brown or brownish yellow mottles. Cambic B horizons are dominantly yellowish brown, dark yellowish brown, brown, olive brown or light olive brown silty clay loam or silt loam with common or many distinct or prominent gray, dark gray, dark grayish brown, grayish brown or very dark grayish brown mottles. Cg horizons are gray, dark gray, bluish gray or greenish gray silt loam, silty clay loam or silt mildly to strongly alkaline weakly stratified marine materials.

Competing Series and Their Differentiae: These are the Hagseong, Bongrim, Gwanghwal, Sugye, Daldong, Deunggu, Gimhae, and Haecheog soils. The Hagseong soils have fewer brown mottles and sandy substrata, and are poorly drained. The Bongrim soils have dark gray colors and are very poorly drained. The Gwanghwal soils have dark gray colors, contain toxic salt and are very poorly drained. The Sugye soils have strongly acid to medium reaction and are formed on broad continental alluvial plains. The Daldong soils are similar except for having sandy substrata. The Deunggu soils have grayer colors and coarse loamy substrata. The Gimhae soils have fine clayey textures. The Haecheog soils have grayer colors, coarse loamy substrata textures and are very poorly drained. The Deogha soils have grayer colors, poor drainage and sea shells in the Cg horizons.

Setting: Level to nearly level broad fluvio-marine plains. Slopes ranges from 0 to 2 percent and average about 0.5 percent.

Principal Associated Soils: The Gimje, Bongnam, Mangyeong and Buyong soils are associated. The Gimje and Bongnam soils have fine clayey textures and dark colored organic mineral layers in the Cg horizons. The Buyong soils have fine clayey textures, grayer colors and occupy somewhat lower landscape positions. The Mangyeong soils have grayer colors and coarse silty textures.

Drainage and Permeability: Imperfectly drained. Permeability is probably moderately slow. Natural runoff is ponded or very slow. Runoff is largely artificially controlled.

Use and Vegetable: Most areas of these soils are double cropped with paddy rice during wet summer and barley during dry winter and spring seasons.

Distribution and Extent: The Jeonbug soils are of large extent and are distributed in the southwest coastal plain areas.

Series Established: Gimje Gun, Jeollabug Do, Sangweol Ri, Jinbong Myeon, 23 October 1967.

Lab. Nos. Dm312-318 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	Ap1g	0.0		0.8		0.8	9.5	71.1	17.8	SiL	1.0	53.3	27.9	CL
10- 19	Ap2g	0.0		0.2		0.7	0.9	79.9	18.3	SiL	0.4	52.9	28.4	CL
19- 27	B1g	0.0		0.2		0.5	8.0	69.7	21.6	SiL	0.3	50.4	27.7	CL
27- 44	B21g	0.0		0.1		0.4	5.4	65.1	29.3	SiCL	0.2	40.1	30.4	LiC
44- 85	B22	0.0		0.3			1.8	70.5	27.4	SiCL	0.0	35.9	36.7	LiC
85-120	B3g	0.0		0.1		0.5	3.4	69.4	26.6	SiL	0.2	39.1	34.1	LiC
120-160	C1g	0.0		0.1		0.5	5.0	72.7	22.1	SiL	0.2	47.6	30.1	CL

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
41.4	30.3	8.6	4.6	4.2	2.11	8.20	2.28	2.12	0.37	0.12	1.12	59.0	81.4
38.5	27.4	9.2	4.7	4.3	1.37	8.80	2.65	2.75	0.50	0.12	1.11	68.4	84.4
33.8	28.2	10.2	6.1	5.4	0.63	9.00	3.50	4.38	0.57	0.10	0.05	95.0	99.4
33.6	28.7	13.8	6.5	5.6	0.32	12.60	4.87	6.37	0.85	0.15	0.05	97.1	99.6
40.9	33.7	19.2	6.5	5.4	0.21	15.80	4.75	9.75	1.38	0.22	0.05	101.9	99.7
41.8	35.4	15.3	6.7	5.4	0.21	16.00	4.50	10.50	1.50	0.40	0.05	105.6	99.7
41.6	34.7	14.0	6.6	5.3	0.63	14.50	3.75	9.50	1.38	0.47	0.05	104.1	99.7

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
Rev. UKT, KBJ, JFD
16 May, 1969

JEONGJA SERIES

The Jeongja series is a member of the fine loamy, mixed, mesic family of Lithic Eutrochrepts (Lithosols). These soils are shallow with thin dark reddish brown cobbly loam A horizons, and thin reddish brown cobbly clay loam cambic B horizons. C horizons are very thin and overlie relatively unweathered dark colored basic crystalline residual rocks beginning within 50 cm. of the surface.

Typifying Pedon: Jeongja angular cobbly loam - forest (Field description Ulju Gun, profile No. 99; colors are for moist soil.)

A -- 0 to 11 cm. Dark reddish gray (5YR 4/2) gravelly to cobbly loam; weak medium and coarse subangular blocky structure breaking readily to moderate fine granular; friable, slightly sticky and plastic; common fine and medium discontinuous random inped dendritic and closed interstitial pores; about 15 percent slightly weathered angular gabbro gravel and cobbles; common medium and coarse prominent krotovinas; many fine medium and coarse living pine tree and wild grass roots; gradual smooth boundary; pH 6.0.

B -- 11 to 38 cm. Dark reddish brown (5YR 3/2) angular gravelly and cobbly clay loam; moderate fine and medium granular structure; friable, slightly sticky and plastic; few fine discontinuous random inped closed vesicular pores; common fine to medium krotovinas; many fine and medium living pine tree and wild grass roots; abrupt smooth boundary; pH 6.0.

R -- 38 cm. Hard gabbro bedrock materials.

Type Location: Ulju Gun, Gyeongsangnam Do, about 50 m. west of Jeongja Ri, Gangdong Myeon on hill side north of road.

Range in Characteristics: Solum thickness over hard gabbro or similar materials is less than 50 cm. Base saturation is commonly more than 60 percent. Reaction is medium to slightly acid. A horizons are 10 to 20 cm. thick, reddish brown to dark reddish brown, dusky red, dark reddish gray or dark brown generally angular gravelly or cobbly loam but including light clay loam or silty clay loam. The cambic B horizons are 10 to 20 cm. thick, reddish brown, dark reddish brown or dusky red gravelly loam, light clay loam or silty clay loam with weak subangular blocky structure. C horizons are thin, more cobbly and slightly coarser textured. The bedrocks are usually dark colored slightly weathered basic crystalline materials such as gabbro, diorite, diabase or syenite. Coarse fragment content is less than 35 percent throughout the profiles. The occurrence of bedrock outcrops ranges from few to very rocky.

Competing Series and Their Differentiae: These include the Habin, Mudeung, Jangseong, Nagseo and Samgag soils. The Habin soils are cobble free and are developed on red shale materials. The Mudeung soils have lighter colors and are derived from andesite porphyry parent materials. The Samgag soils have coarse loamy textures and are developed on deeply weathered granitic materials. The Jangseong soils have neutral reaction and are formed from limestone parent materials. The Nagseo soils contain mica and are formed from schist parent materials.

Setting: The Jeongja soils are developed on hilly to steep mountain slopes and are underlain by basic igneous crystalline rocks. Slopes range from 20 to 60 percent and more.

Principal Associated Soils: The dark red fine clayey Cheongog series is associated on smoother relief from similar parent materials. The Sinjeong and Mudeung soils are associated on tuff conglomerate and andesite porphyry parent materials.

Drainage and Permeability: Somewhat excessively drained. Permeability is moderate. Runoff is rapid or very rapid after saturation.

Use and Vegetation: Coniferous and some deciduous trees with wild grasses and shrub understory commonly grow on these soils. The smoother slopes are sometimes used for upland crops such as barley, buckwheat, cabbage, red pepper and radish.

Distribution and Extent: The Jeongja soils are of small extent on dark colored basic crystalline materials in hills and mountainous areas throughout the country.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966

Remarks: The clay content of the typifying pedon is slightly low and the coarse fragments were not included in the sample collected for analysis.

Lab. Nos. U533-534 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) %: U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 11	A	2.0	4.5		11.5	17.2	7.0	42.4	17.4	L	20.7	32.1	29.8	CL
11- 38	B	1.8	7.4		13.0	18.7	8.5	34.5	17.9	L	25.4	34.2	22.5	CL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	CEC 2/	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	31.8	19.6	5.7	4.3	2.46	17	25.00	13.90	11.65	0.14	0.35	0.19	104.2	99.3
	32.0	21.4	5.8	4.3	2.46	11	30.00	17.15	11.60	0.29	0.17	0.19	97.4	99.4

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KBJ, JFD
16 October, 1969

JEONNAM SERIES

The Jeonnam series is a member of the fine clayey, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have thin brown silt loam A horizons and very deep red silty clay loam Bt horizons. C horizons are strong brown silt loam very deeply weathered residual granitic saprolite. They occur on rolling and hilly relief.

Typifying Pedon: Jeonnam silt loam, eroded - forest (Field description Gwangsan Gun profile No. 111; colors are for moist soil.)

A -- 0 to 6 cm. Strong brown (7.5YR 5/6) silt loam; moderate medium to course granular structure; friable, sticky and plastic; about 4 percent fine slightly weathered angular quartz gravel; few fine mica flakes; many fine grass roots; clear smooth boundary.

B1 -- 6 to 18 cm. Strong brown (7.5YR 5/6) clay loam; weak medium to coarse subangular blocky structure; firm, sticky and plastic; thin broken dark brown (7.5YR 4/4) clay cutans; common medium to coarse discontinuous inped tubular closed pores; few angular quartz gravel and grit; few fine white mica flakes; common fine grass roots; clear wavy boundary.

B21t -- 18 to 35 cm. Yellowish red (5YR 5/8) clay loam; moderate medium to coarse subangular blocky structure; firm, sticky and plastic; common thin broken clay cutans; common medium to coarse discontinuous inped tubular closed pores; few angular quartz gravel and grit; few fine grass roots; gradual wavy boundary.

B22t -- 35 to 67 cm. Yellowish red (5YR 4/8) clay; moderate fine to medium subangular blocky structure; firm, very sticky and very plastic; many thin continuous clay cutans; few fine white mica flakes; common medium to coarse discontinuous inped tubular closed pores; few angular quartz grit and fine gravel; few fine grass roots; gradual wavy boundary.

B31t -- 67 to 94 cm. Strong brown (7.5YR 5/8) to yellowish red (5YR 5/8) light clay; moderate fine to medium subangular blocky structure; firm, very sticky and very plastic; common thin broken clay cutans; mica and grit as above; common medium to coarse discontinuous inped tubular closed pores; very few very fine grass roots; gradual wavy boundary.

B32t -- 94 to 140 cm. Reddish brown (5YR 5/4) light clay; many coarse faint mottles of strong brown (7.5YR 5/6); crushed color brown to dark brown (7.5YR 4/4); moderate fineto medium angular blocky structure; firm, sticky and plastic; common thin continuous clay cutans; common fine white and yellow mica flakes; very few fine roots.

Type Location: Gwangsan Gun, Jeollanam Do, about 1 km. west Yongbog Ri, Donggog Myeon, near Naju and Gwangsan Gun boundary west side of road.

Range in Characteristics: The solum thickness is 125 cm. or more except where severely eroded. Depth to hard rock is commonly greater than 3 meters, ranging to 10 meters or more as hard bedrock is rarely observed in existing excavations. Reaction ranges from strongly to medium acid throughout. Few to common mica flakes occur throughout the profiles. Base saturation is mainly low. A horizons are brown to dark brown where only slightly eroded, strong brown or reddish brown where eroded, commonly silt loam to silty clay loam but include clay loam. Bt horizons are dominantly red or yellowish red, but may include some subhorizons of strong brown, silty clay loam to silty clay with moderately developed subangular blocky structure and broken or continuous thin clay cutans. The C horizons are strongly and very deeply weathered usually strong brown, yellowish brown, pale brown and reddish yellow silty clay loam, loam, silt loam or sandy loam granitic saprolite below 150 cm.

Competing Series and Their Differentiae: These are the Gwangsan, Dalcheon, Jingog, Bonggye, Sirye and Pansan soils. The Gwangsan soils have more strongly developed structure, somewhat redder colors and thicker more continuous clay cutans. The Dalcheon soils have only moderately deep soils. The Jingog soils have thick yellowish brown silty mantles over residual Bt horizons. The Bonggye soils are mica free and have less thick C horizons. The Sirye soils are moderately deep and are derived from grayish brown shale materials. The Pansan soils have dark colored A horizons and deep residual Btb horizons.

Setting: The Jeonnam series occurs in residuum on gently sloping to moderately steep slopes with low rolling and hilly relief in areas underlain by deeply weathered granitic saprolite. The slopes range from 2 to 30 percent. 5 to 15 percent slopes are dominant.

Principal Associated Soils: The Jisan, Pansan and Baegsan soils are associated on the lower foot slopes and in local valleys. The Gwangsan and Jingog soils are usually associated on similar physiography. The Dalcheon, Songjeong and Samgag soils are associated on steeper side slopes and higher hills.

Use and Vegetation: Most areas of these soils are used for upland crops such as barley, wheat, corn, millet, sweet potato, radish and potato. The remaining areas grow forest, mulberry and fruit orchards.

Drainage and Permeability: Well drained. Permeability is slow. Runoff is moderate to rapid.

Distribution and Extent: These soils are of moderate extent and occur throughout the southern and central parts of the country in rolling and hilly uplands underlaid by deeply weathered granitic materials.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Remarks: The typifying pedon has yellowish red Bt horizons whereas the central concept has red colors. The range of base saturation in this and similar residual granitic soils is mostly between 15 and 35 percent; however many profiles have base saturation between 35 and 60 percent. There appears to be no way at the present time to separate these soils in the field at the 35 percent level. These series are therefore placed in the Typic subgroup and the 35 to 60 percent portion is considered as a taxonomic inclusion.

I b. Nos. K270-275 **Typifying Pedon**

			Particle Size Distribution												
			U. S. Department of Agriculture								International				
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 6	A	3.8	4.8	4.7	4.0	4.2	2.3	54.3	25.7	SiL	14.7	22.0	30.7	LiC
6- 18	B1	2.5	1.7	3.4	3.1	3.2	1.8	58.4	28.4	SiCL	9.0	20.6	42.0	LiC
18- 35	B21t	2.5	1.2	2.4	2.4	2.2	1.3	55.8	34.7	SiCL	6.5	15.8	43.0	LiC
35- 67	B22t	0.7		3.0		1.4	1.2	52.4	42.0	SiC	3.4	14.4	40.2	LiC
67- 94	B31t	0.5		3.2		1.5	1.0	58.8	35.5	SiCL	3.6	11.2	49.7	SiC
94-140	B32t	0.7		3.3		1.5	1.0	60.1	34.1	SiCL	3.7	18.2	44.0	LiC

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
	29.5	10.7	4.9	3.6	2.80	9	6.60	0.80	0.20	0.12	0.22	3.37	20.3	28.5
	29.3	10.7	5.2	3.8	1.15	4	6.64	0.30	0.10	0.36	0.16	2.56	13.9	26.4
	27.1	11.5	5.5	4.0	1.25	0		0.80	0.00	0.12	0.12	3.40		23.4
	28.8	14.6	5.0	3.7	0.35	0	5.68	1.50	0.50	0.22	0.16	3.68	41.9	39.3
	29.1	11.3	4.9	3.7	0.14	-	7.06	1.50	0.70	0.30	0.16	-	37.6	-
	31.3	12.0	5.0	3.6	0.31	-	7.88	1.50	1.60	0.22	0.16	-	44.1	-

Elemental Analysis of Clay							3
H_2O %	Igni Loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	CEC me/100g
3.52	9.27	2.15	46.48	9.27	30.79	2.36	-
4.12	9.66	2.06	45.08	9.96	30.82	2.46	42.54
-	-	-	-	-	-	-	-
6.58	9.37	2.23	46.40	10.93	28.36	2.54	52.55
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	47.54

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, 1 N NaCl Extracted.

Established Series
UhT, KBJ, JFD
16 October, 1969

JINGOG SERIES

The Jingog series is a member of the fine clayey, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have a shallow yellowish brown fine silty mantle overlying a deep yellowish red fine clayey Btb horizon developed from deeply weathered residual granitic saprolite. They occur on remnants of strongly dissected old pediplanes.

Typifying Pedon: Jingog silty clay loam - sweet potato (Field description Gimje Gun profile No. 149; colors are for moist soil.)

Ap -- 0 to 9 cm. Strong brown (7.5YR 5/6) silty clay loam; weak fine granular structure; friable, sticky and plastic; many fine pores; many fine to medium roots; clear smooth boundary.

B11 -- 9 to 20 cm. Strong brown (7.5YR 5/8) silty clay loam; weak fine to medium subangular blocky structure breaking to strong fine granular; friable, sticky and plastic; pores as above; roots as above; clear smooth boundary.

B12 -- 20 to 40 cm. Brown to dark brown (7.5YR 4/4) silty clay loam; weak fine to medium subangular blocky structure; friable, sticky and plastic; pores as above; few earth worm holes; few fine roots; clear smooth boundary.

B21tb -- 40 to 60 cm. Strong brown (7.5YR 5/6) silty clay; many fine to medium prominent yellowish red (10YR 5/8) mottles; moderate fine to medium subangular blocky structure; continuous thin and thick clayey cutans; firm, very sticky and very plastic; common fine pores; few fine roots; gradual wavy boundary.

B22tb -- 60 to 105 cm. Mottled yellowish red (5YR 4/8) and strong brown (7.5YR 5/8) silty clay; crushed color yellowish red (5YR 5/8); strong fine to medium angular blocky structure; continuous thick brown (10YR 5/3) clayey cutans; firm, very sticky and very plastic; many medium to coarse black (10YR 2/1) Mn concretions; common fine to medium pores; no roots; clear wavy boundary.

B23tb -- 105 to 170 cm. Mottled red (2.5YR 4/6), strong brown (7.5YR 5/8), pale brown (10YR 6/3) and black (10YR 2/1) silty clay loam; crushed color yellowish red (5YR 5/8); moderate coarse platy breaking to moderate fine to medium angular blocky structure; continuous thin pale brown clayey cutans; firm, very sticky and plastic; many coarse black (10YR 2/1) Mn concretions; common fine to coarse pores.

Type Location: Gimje Gun, Jeollabug Do, about 300 meters northeast from Jincheon Dong (Jinheung Ri), Hwangsan Myeon.

Range in Characteristics: Depth of the silty mantle ranges from about 30 to 70 cm. and averages about 40 cm. thick over a Btb formed in granitic residuum which ranges from 100 to 200 cm. thick. Depth to bedrock is probably more than 5 meters. Reaction ranges from very strongly to strongly acid and is lowest in the silty mantle. Base saturation is low in the mantle and medium or low in the Btb. A1 or Ap horizons are thin, brown to dark brown or strong brown silt loam or light silty clay loam. When dry, A horizons have pale brown or similar colors. Cambic B horizons are developed in the fine silty mantle. They are yellowish brown, strong brown or brown to dark brown silty clay loam or heavy silt loam. Clay cutans are generally absent and the grit content is very low in the mantle materials. Weak platy structure may occur where the mantle contacts residuum. The Btb horizons are yellowish red or red heavy silty clay loam, clay loam, silty clay or clay with strong brown or yellowish brown mottles with dominant chromas of 3 or more below 100 cm. The C horizons are usually extremely weathered very deep, red, yellowish red, strong brown or yellowish brown silty clay, silty clay loam, silt loam or loam granitic saprolite. More than 10 percent mica occurs in the control section.

Competing Series and Their Differentiae: These are the Gwangju, Gwangsan, Jeonnam, Dalcheon, Bonggye, Bansan and Cheongog soils. The Gwangju soils have similar silty mantle materials in the upper horizons but the lower Btb horizons are developed in old alluvium. The Gwangsan and Jeonnam soils do not have silty mantle upper horizons but have deep residual Bt horizons. The Dalcheon soils have no silty mantle but have moderately deep Bt horizons. The Bonggye soils have no silty mantles, are mica free and are derived from andesite porphyry materials. The Bansan soils have dark colored A horizons and lack silty mantles. The Cheongog soils have dark red colors, lack silty mantles and are derived from dark colored residual basic rocks.

Setting: The Jingog series occurs on gently sloping and sloping remnants of strongly dissected rolling old bedrock pediplanes and in slight creep positions underlain by deeply weathered residual granitic saprolite. Slopes are dominantly 2 to 5 percent and range from 2 to 15 percent.

Principal Associated Soils: The Bancheon, Songjeong, Gwangju, Gwangsan, Jeonnam and Bansan soils are associated. The Bancheon and Gwangju soils are associated on dissected river terraces. The Bansan soils are associated in slightly concave well drained landscape positions. The Gwangsan, Jeonnam and Songjeong soils occur in residual upland positions.

Drainage and Permeability: Well drained. Permeability is very slow and runoff is moderately slow or medium with some tendency to accumulate in some areas.

Use and Vegetation: Most areas are used for cultivated crops such as sesame, soybean, red pepper, sweet potato, potato and tobacco. A small extent grows mulberry and pine forest.

Distribution and Extent: The Jingog series is of small extent and occurs in southern part of the country mostly in areas of strongly dissected rolling pediplanes.

Series Established: Gwangsan Gun, Jeollanam Do, 1967.

Remarks: The brown to dark brown B horizon in the typifying pedon is more brown than typical. The color concept of the silty mantle should be centered on yellowish brown to strong brown. The mantle materials are considered by some observers to have characteristics of loess. While other observers consider the material to be local creep or local alluvium. The range of base saturation in this and similar residual granitic soils is mostly between 15 and 35 percent; however, many profiles have higher base saturation. There appears to be no way to separate these soils at the 35 percent level at the present time. These series are therefore placed in the typic subgroup and the portion above 35 percent is considered as a taxonomic inclusion.

Lab. Nos. Dm435-440 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori-zon	Gra-vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05 .002	Clay <.002	Tex-tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 9	Ap	0.0	——	2.1	——	1.1	1.2	66.9	28.7	SiCL	2.4	20.8	48.1	SiC
9- 20	B11	0.0	——	1.8	——	0.8	1.0	68.0	28.4	SiCL	2.0	22.3	47.3	SiC
20- 40	B12	0.0	——	1.5	——	1.1	1.5	66.4	29.5	SiCL	1.8	21.4	47.3	SiC
40- 60	B21tb	0.0	——	1.4	——	0.6	0.8	60.0	37.2	SiCL	1.6	15.7	45.5	SiC
60-105	B22tb	0.0	——	1.1	——	0.8	0.9	56.6	40.6	SiC	1.4	16.0	42.0	LiC
105-170	B23tb	0.0	——	2.7	——	1.3	1.4	55.3	39.3	SiCL	3.0	16.4	41.3	LiC

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
39.1	32.9	10.6	4.9	4.1	1.46	17	7.20	0.25	0.06	0.08	0.12	3.60	7.4	12.8
38.3	32.0	11.8	4.9	4.2	1.21	10	6.85	0.20	0.08	0.08	0.08	3.55	6.4	11.0
34.9	30.7	11.2	4.9	4.1	0.84	6	7.60	0.10	0.08	0.25	0.08	3.90	6.7	11.6
35.0	31.1	15.2	5.1	4.1	0.40	-	9.30	0.22	0.85	0.25	0.08	4.80	15.1	22.5
36.3	32.7	17.1	5.2	4.0	0.36	-	9.60	0.57	1.90	0.42	0.12	3.65	31.4	45.2
38.2	34.6	16.5	5.2	4.1	0.29	-	10.60	1.95	5.75	0.22	0.10	2.95	75.7	73.1

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

JISAN SERIES

The Jisan series is a member of the fine loamy, mixed, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick dark grayish brown loamy Apg horizons and very thick grayish brown light clay loam cambic Bg horizons with yellowish brown and yellowish red mottles. Cg horizons are dark gray loam with a few mottles and some gravel in places. They are developed in weakly stratified local alluvial materials in gently sloping narrow valley alluvium and on alluvial fans derived from granite, andesite porphyry and similar soil materials.

Typifying Pedon: Jisan loam - rice paddy (Field description Buyeo Gun profile No. 186; colors are for moist soil.)

Ap1g -- 0 to 12 cm. Dark grayish brown (2.5Y 4/2) loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak medium granular structure; friable, slightly sticky and slightly plastic; few fine mica; many fine rice roots; abrupt smooth boundary.

Ap2g -- 12 to 30 cm. Olive gray (5Y 5/2) light clay loam; few fine prominent dark yellowish brown (10YR 4/4) mottles; weak coarse platy and medium subangular blocky structure; firm, sticky and plastic; common fine pores; common fine mica; clear smooth boundary; pH 5.5.

B2g -- 30 to 65 cm. Grayish brown (2.5Y 5/2) clay loam; common fine faint brown (10YR 5/8) mottles; crushed color light olive brown (2.5Y 5/4); weak very coarse prismatic structure; thin discontinuous gray exprism cutans; common fine pores; common fine mica; clear smooth boundary.

B3g -- 65 to 100 cm. Gray (5Y 5/1) light clay loam; many medium prominent yellowish brown (10YR 5/8) mottles; moderate coarse prismatic structure decreasing with depth; firm, sticky and plastic; thin broken grayish brown (2.5Y 5/2) exprism cutans; common fine mica; abrupt smooth boundary; pH 6.5.

Cg -- 100 to 170 cm. Very dark gray (5Y 3/1) loam; few yellowish brown mottles; structureless (massive); slightly sticky and slightly plastic.

Type Location: Buyeo Gun, Chungcheongnam Do, 100 meters southeast Jeom Ri, Nam Myeon.

Range in Characteristics: Solum thickness ranges from 75 cm. to 125 cm. and depth to hard rock is generally more than 3 meters. Base saturation is more than 60 percent. Reaction is medium to slightly acid. Common mica is present. Apg horizons are 20 to 30 cm. thick, grayish brown, dark grayish brown, light gray or gray silt loam, loam, clay loam or silty clay loam with prominent yellowish red, strong brown or yellowish brown mottles. Bg horizons are 50 to 100 cm. deep, gray, grayish brown, dark grayish brown, very dark grayish brown or olive gray loam, clay loam or silty clay loam with common prominent yellowish red, red, strong brown, yellowish brown or reddish brown mottles. Clay content of the Bg horizons ranges from 18 to 35 percent. The Cg horizons are gray, grayish brown, very dark grayish brown or dark grayish brown stratified silty clay loam, loam or loamy sand with mottles. Some layers contain gravel.

Competing Series and Their Differentiae: These include the Hyocheon, Yongji, Yuga, Baeggu, Honam and Sinheung series. The Hyocheon soils contain ferrous carbonate mottles. The Yongji soils have browner colors and are better drained. The Yuga soils have fine silty textures and gray shale soils source materials. The Baeggu soils have somewhat grayer colors and $FeCO_3$ mottles in the Bg horizons. The Honam soils have fine clayey textures and argillic Bg horizons. The Sinheung soils have less gray colors, thicker Cg horizons and are developed on broad alluvial plains.

Setting: The Jisan soils occur in gently sloping to sloping narrow local valleys and on fans in alluvium derived from granitic, andesite porphyry and similar materials. Dominant slopes are 2 to 7 percent and slope range is from 2 to 30 percent.

Principal Associated Soils: The Jisan soils are associated with the Yongji, Sachon, Songjeong, Samgag, Jeonnam, Dalcheon, Mudeung, Taehwa and Bonggye series. The Songjeong, Samgag, Dalcheon and Jeonnam soils are in residual upland positions above the Jisan soils in granitic areas. The Mudeung, Taehwa and Bonggye soils are associated in upland positions in andesite porphyry areas. The Yongji soils are in slightly higher local alluvial positions with moderately deep ground water tables. The Sachon soils have coarse loamy textures and imperfect drainage.

Drainage and Permeability: Poorly drained. Permeability is probably moderate or moderately slow and runoff is controlled as all areas are level terraced and dyked for paddy rice land use.

Use and Vegetation: All areas are used for paddy rice during wet summer seasons. Many areas are used also for barley or wheat during dry winter seasons.

Distribution and Extent: The Jisan soils are of moderate extent and are distributed in local valleys throughout the granitic and porphyry areas of the country.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Remarks: The drainage of this series was considered as imperfect before placement in the new classification system because double crops can be grown.

Jisan Series Contd.

Lab. Nos. Cg170-174 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	VCS 1-5	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
			Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture								International			
0- 12	Ap1g	2.1	4.4	4.0	7.0	8.5	7.8	45.3	23.0	L	16.6	26.3	34.1	CL
12- 30	Ap2g	3.6	3.1	5.0	8.7	9.3	7.8	41.5	24.6	L	18.2	25.4	31.8	CL
30- 65	B2g	2.7	3.9	5.6	8.6	9.3	7.5	44.8	20.3	L	19.7	37.4	22.6	CL
65-100	B3g	1.9	3.6	5.3	8.2	8.8	7.5	41.9	24.7	L	18.8	26.8	29.7	CL
100-170	Cg	1.7	3.0	5.8	1.4	12.7	8.3	47.5	21.3	L	12.2	40.9	25.6	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	pH 1 N KCl	O.M. %	2/ CEC	Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
						me/100g (Extractable Cations)							
48.9	44.4	28.6	5.1	4.0	3.24	9.50	2.95	2.05	0.28	0.13	0.14	56.9	97.5
40.7	36.3	18.9	5.7	4.5	2.46	8.20	4.30	3.00	0.20	0.13	0.11	93.0	98.6
37.0	33.9	11.6	6.5	5.1	0.88	7.70	4.05	2.70	0.33	0.10	0.05	90.6	99.3
40.5	37.9	14.5	6.4	5.0	1.03	9.50	5.34	3.78	0.16	0.12	0.05	98.9	99.5
37.9	33.0	10.3	5.3	3.9	1.08	9.50	3.70	2.80	0.20	0.10	0.38	68.7	94.7

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UFT, JFD
20 October, 1969

JUNGDONG SERIES

The Jungdong series is a member of the coarse loamy, mixed, mesic family of Typic Udifluvents (Alluvial soils). They have brown moderately thick fine sandy loam Ap horizons and very deep yellowish brown fine sandy loam C horizons with less than 18 percent clay and more than 15 percent coarser than very fine sand. They occur on broad continental alluvial flood plains and are derived from recently deposited alluvial materials.

Typifying Pedon: Jungdong fine sandy loam - mulberry (Field description Sangju Gun profile No. 165; colors are for moist soil.)

Ap1 -- 0 to 10 cm. Brown to dark brown (10YR 4/3) fine sandy loam; weak fine granular structure; friable, slightly sticky and nonplastic; few fine discontinuous random exped dendritic interstitial pores; many fine living mulberry roots; common fine white mica; clear smooth boundary; pH 5.0.

Ap2 -- 10 to 25 cm. Dark yellowish brown (10YR 4/6) fine sandy loam; weak medium granular structure; friable, slightly sticky and nonplastic; few fine and coarse continuous oblique exped simple tubular pores; many fine and medium living mulberry roots; mica as above; abrupt smooth boundary; pH 5.0.

C1 -- 25 to 40 cm. Yellowish brown (10YR 5/6) fine sandy loam; moderate fine granular structure; very friable, slightly sticky and nonplastic; few fine discontinuous oblique exped tubular pores; common fine and medium living mulberry roots; abrupt smooth boundary; pH 4.7.

C2 -- 40 to 100 cm. Mottled yellowish brown (10YR 5/4) and pale brown (10YR 6/3) fine sandy loam; crushed color yellowish brown (10YR 5/6); weak fine and medium granular structure; very friable, slightly sticky and slightly plastic; pores as above; few fine and coarse living mulberry roots; stratified with very thin sandy layers; clear smooth boundary; pH 5.4.

C3 -- 100 to 170 cm. Pale brown (10YR 6/3) fine sandy loam; common coarse distinct strong brown (7.5YR 5/6) mottles; crushed color yellowish brown (10YR 5/6); weak fine granular structure; very friable, slightly sticky and slightly plastic; few fine to medium discontinuous oblique exped simple tubular pores; no roots; pH 6.5.

C4g -- 170 to 200 cm. Dark gray (2.5Y N4/) loam; structureless (massive); slightly sticky and slightly plastic; pH 6.2.

Type Location: Sangju Gun, Gyeongsangnam Do, 1 km. east of Sangju Eup, Sericultural Institute (mulberry field), Bongyong Dong, Sangju Eup.

Range in Characteristics: Depth of soil is more than 2 meters over very contrasting strata and probably more than 4 meters over hard rock. The ground water table usually occurs below 150 cm. Reaction is strongly to medium acid except where limed. Common fine mica occurs throughout the profiles. Base saturation is more than 60 percent. Ap or A1 horizons are thin or moderately thick, brown to dark brown or dark yellowish brown, fine sandy loam, sandy loam, loamy very fine sand or very fine sandy loam. The C horizons are 150 cm. or more deep, dark yellowish brown, yellowish brown, pale brown or light yellowish brown weakly stratified sandy loam, very fine sandy loam, loamy very fine sand or fine sandy loam with common fine mica. The lower C horizons below about 200 cm. may be dark gray due to ground water gleying, sandy loam or sand.

Competing Series: These are the Sangju, Seongsan, Tongcheon, Nagdong, Hwabong, Bonryang and Ihyeon soils. The Sangju soils contain fine gravel throughout and occur on footslopes and fans. The Seongsan soils have yellowish red colors and occur in footslope and fan positions. The Tongcheon soils have loamy skeletal textures and higher watertables between 50 and 100 cm. The Nagdong and Hwabong soils have sandy textures. The Bonryang soils have coarse loamy over sandy textures. The Ihyeon soils have coarse silty textures.

Setting: The Jungdong soils occur on continental flood plains along the larger rivers and are derived from mixed recent alluvial materials. Most areas are dyked and only few areas are subject to flooding. Dominant slopes are about 1 percent and range from 0 to 2 percent.

Principal Associated Soils: The Jungdong soils are associated with the Hwabong, Gyuam, Nagdong and Ihyeon soils in similar physiographic positions. The Gyuam soils have coarse silty textures and higher water tables.

Drainage and Permeability: Well drained. Permeability is probably moderate or moderately rapid and runoff is slow.

Use and Vegetation: Most of these soils are used for peanuts, barley, soybean, radish, buckwheat, cabbage and similar crops. Few areas are used for paddy rice.

Distribution and Extent: The Jungdong soils are of moderate extent and occur on broad alluvial plains along the main rivers throughout the country.

Series Established: Sangju Gun, Gyeongsangbug Do, November 1969.

Jungdong Series Contd.

Lab. Nos. Fr76-81 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	Ap1	3.7	2.6	3.8	11.4	30.0	20.9	27.0	4.3	FSL	21.4	61.4	12.9	FSL
10- 25	Ap2	1.8	1.2	2.4	9.5	30.4	24.8	27.0	4.7	FSL	15.4	67.5	12.4	FSL
25- 40	C1	0.6	1.0	3.2	14.6	29.3	21.7	26.7	3.5	SL	22.4	62.4	11.7	FSL
40-100	C2	0.2	0.3	1.0	7.2	27.8	26.8	32.9	4.0	SL	11.3	73.0	11.7	FSL
100-170	C3	0.3	1.3	2.7	10.8	27.6	16.7	36.3	4.6	SL	19.0	61.4	15.0	LFS
170-200	C4g	0.0	0.3	0.7	1.5	19.9	28.4	42.7	7.2	SL	3.9	68.6	20.3	FSL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations Ca	Mg	Na	K	H
								me/100g					
37.5	16.7	6.8	-	5.2	3.9	1.23	167	7.0	3.75	1.15	0.18	0.40	0.35
38.1	16.6	6.3	1.19	5.2	3.4	1.13	174	6.9	3.40	0.70	0.10	0.40	0.35
31.1	13.9	5.1	1.29	5.0	3.1	0.41	68	5.8	1.55	0.60	0.05	0.13	2.77
40.1	15.9	5.6	1.28	5.6	3.4	0.41	20	6.4	3.20	1.25	0.13	0.13	0.86
34.1	18.8	5.7	-	6.3	4.3	0.41	18	5.2	3.75	1.20	0.20	0.13	0.05
39.8	24.9	6.7	-	5.6	3.9	0.67	52	6.0	3.65	2.05	0.28	0.13	0.45

Base Saturation % CEC	Sum of Cations
78.3	94.0
66.7	92.9
40.2	45.7
73.6	84.6
101.5	99.1
101.8	93.1

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
20 November, 1969

MAJI SERIES

The Maji series is a member of the loamy skeletal, mixed, mesic, nonacid family of Fluventic Hapludolls (Alluvial soils). These soils have moderately thick dark brown gravelly loam A horizons and moderately deep brown to dark brown very gravelly or very cobbly loam cambic B horizons. C horizons are very gravelly or very cobbly loam. Maji soils are developed on local alluvial fans and terraces in alluvial-colluvial materials derived from limestone soils.

Typifying Pedon: Maji gravelly loam - corn (Field description Pyeongchang Gun profile No. 129; colors are for moist soil.)

Alp -- 0 to 13 cm. Dark brown (7.5YR 3/2) gravelly loam; moderate fine to medium granular structure; friable, sticky and plastic; common fine dead soybean and corn roots; approximately 15 percent unweathered limestone gravel and cobbles; diffuse smooth boundary; pH 7.0.

A1 -- 13 to 30 cm. Dark brown (7.5YR 3/2) very gravelly to very cobbly light silty clay loam; weak coarse blocky structure breaking to moderate and fine granular; friable, sticky and plastic; few coarse worm holes and casts; few fine dead soybean and corn roots; approximately 50 percent unweathered limestone gravel and cobbles; gradual smooth boundary; pH 7.0.

B -- 30 to 50 cm. Brown to dark brown (7.5YR 4/4) very gravelly loam; moderate fine granular structure; slightly sticky and slightly plastic; about 60 percent gravel; gradual smooth boundary;pH 7.0.

C -- 50 to 100 cm. Brown to dark brown (7.5YR 4/4) very cobbly loam; moderate fine granular structure; firm, slightly sticky and slightly plastic; more than 80 percent gravel and cobbles; pH 7.5.

Type Location: Pyeongchang Gun, Gangweon Do, about 50 meters north of Jujin Primary School, Pyeongchang Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to bedrock is generally more than 3 meters. The solum contains 35 to 90 percent mostly angular limestone gravel and cobble which increase with depth. In places these fragments have been removed from the Ap horizons by farmers. Reaction is slightly acid to mildly alkaline. Base saturation is usually more than 50 percent throughout the profiles. Ap horizons are 20 to 30 cm. thick , dark brown, very dark brown or black gravelly loam, silt loam, loam, clay loam or silty clay loam with more than 1.0 percent organic matter. Cambic B horizons are 50 to 100 cm. thick, dark brown or brown, very gravelly and or very cobbly light clay loam, loam, silty clay loam or silt loam with 35 to 90 percent angular limestone gravel and cobbles. C horizons are very deep brown to dark brown, strong brown or brown weakly stratified very gravelly and or very cobbly loam, silt loam or fine sandy loam with 50 to 90 percent limestone gravel and cobbles. Coarse fragments generally increase with depth.

Competing Series and Their Differentiae: These are the Hogye, Sinbul, Imog, Anmi, Seogto and Sinbul soils. The Hogye soils have medium to slightly acid reaction, chiefly 10YR hues and are derived from noncalcareous soil materials such as granite, andesite porphyry and some shale. The Sinbul soils occur in steep colluvial positions at high elevations in mountainous areas, have medium base saturation, yellowish brown cambic B horizons and are derived from acidic crystalline soil materials. The Imog soils have coarse loamy textures. The Anmi soils have fine loamy textures and are free of coarse fragments. The Seogto and Sinbul soils have strongly to medium acid reaction and occur in areas of acid crystalline soil parent materials.

Setting: The Maji soils are on local alluvial fans and in narrow local valley floors in very gravelly and or very cobbly local alluvial and alluvial-colluvial soil materials washed from residual soils in limestone uplands. Dominant slopes are 2 to 7 percent and the range is from 2 to 30 percent.

Principal Associated Soils: The Jangseong, Pyeongchang, Mitan, Pyeongan, Imog and Anmi soils are associated. The Jangseong and Pyeongchang soils occur in residual positions above the Maji soils. The Mitan soils occur in very stony colluvial materials on steep slopes above the Maji soils. The Pyeongan soils occur in dissected mountain colluvial fan positions above the Mitan soils. The Anmi soils occur in similar positions but are free of gravel.

Drainage and Permeability: The Maji soils are well drained. Permeability is probably moderate to moderately rapid. Runoff is medium or rapid depending on the slope.

Use and Vegetation: Most areas are used for corn, soybean, radish, cabbage and similar cool season vegetable crops. Few areas are used for paddy rice.

Distribution and Extent: The Maji soils are in the limestone areas of the country and are of small extent.

Series Established: Pyeongchang Gun, November 1968.

Remarks: The Maji soils in limestone areas are approximate equivalents of the Hogye soils in granitic and porphyry areas.

Lab. Nos. Mh305-306 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 13	A1p	14.2	4.3	7.8	10.4	3.6	11.1	45.5	17.3	L	23.7	26.6	32.4	CL
13- 30	A1	43.0	5.2	8.3	11.7	9.5	6.4	41.3	18.6	L	25.6	27.3	28.5	CL
30- 50	B	-	-	-	-	-	-	-	-	-	-	-	-	-
50-100	C	-	-	-	-	-	-	-	-	-	-	-	-	-

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
31.7	25.8	8.7	6.2	5.1	2.31	10.90	5.02	1.23	0.13	0.25	-	60.8	-
29.0	23.6	9.3	6.6	5.4	2.08	10.50	6.00	0.13	0.13	0.07	-	60.3	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KBJ, JFD
10 April, 1969

MANGSIL SERIES

The Mangsil series is a member of the fine loamy, mixed, mesic family of Humic Hapludults (Acid Brown Forest soils). These soils have thick very dark brown stony loam A horizons, deep yellowish brown stony silty clay loam Bt horizons and occur at high elevations in mountainous regions with moderately weathered andesite parent materials.

Typifying Pedon: Mangsil stony loam - wild grass (Field description Dalseong Gun profile No. 70; colors are for moist soil.)

A11 -- 0 to 10 cm. Very dark brown (10YR 2/2) gravelly and stony silty clay loam; moderate and strong very fine granular structure; very friable, slightly sticky and nonplastic; many fine living grass roots; 15 to 20 percent light colored andesite gravel and stone; clear wavy boundary; pH 6.0.

A12 -- 10 to 25 cm. As above with weak very coarse subangular blocky structure breaking readily to moderate very fine, fine and medium granular; many very fine random pores; pH 6.0.

A3 -- 25 to 40 cm. Very dark grayish brown (10YR 3/2) stony silty clay loam; weak coarse subangular blocky structure; friable, slightly sticky and slightly plastic; many fine pores; abrupt smooth boundary; pH 5.0.

B1t -- 40 to 52 cm. Dark brown (10YR 4/3) stony silty clay loam; moderate coarse subangular blocky structure; friable, sticky and plastic; many fine pores; some infiltration of A horizon materials in upper part of this horizon; few fine living grass roots; clear smooth boundary; pH 5.7.

B2t -- 52 to 90 cm. Yellowish brown (10YR 5/4) stony silty clay loam; moderate medium subangular blocky structure; firm, sticky and plastic; many fine pores; few fine grass roots; clear wavy boundary; pH 5.7.

B3 -- 90 to 150 cm. Yellowish brown (10YR 5/6) stony loam; weak coarse subangular blocky structure; firm, sticky and plastic; common fine pores; clear wavy boundary; pH 5.9.

C -- 150 to 160 cm. Yellowish brown (10YR 5/6) loam; rock structure (weathered massive residual dark colored andesite porphyry).

Type Location: Near the army missile base, Mangsil Mountain top south Daegu City, 1,000 meters elevation, Nangcheon Dong, Chang Myeon, Dalseong Gun, Gyeongsangbug Do.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. and reaction from very strongly to strongly acid. Base saturation is less than 35 percent. Most areas have from 5 to 25 percent angular gravel and stones on the surface and somewhat less in the B horizon. Rock outcrops may occur. A horizons are very dark brown or black stony loam or stony silt loam ranging from 25 to 50 cm. in thickness. B2t horizons are yellowish brown, strong brown or brown stony silty clay loam to clay loam. C horizons have similar colors, loamy textures and residual rock structure. Parent materials are andesite porphyry and similar rocks.

Competing Series and Their Differentiae: These include the Sinbul, Seogto, Bansan, Mui and Wangsan soils. The Sinbul soils have loamy-skeletal textures and are formed in colluvium. The Bansan soils have redder stone free fine clayey subsoils and occur in slight depressions between red soils on dissected old pediplanes at low elevations. The Seogto soils lack B2t and humic A horizons. The Mui soils have coarse loamy textures and contain mica. The Wangsan soils contain few or no coarse fragments, have higher base saturation, contain mica and have somewhat thinner A horizons.

Setting: The Mangsil series occurs mainly on the crests of high mountains at elevations above 600 meters on relatively gentle slopes dominantly with wild grass vegetation. Slopes range from 7 to 60 percent. Dominant slopes are 15 to 30 percent.

Principal Associated Soils: The Mudeung soils are associated on similar parent materials. The Odae and Chahang series are associated in adjacent granitic areas.

Drainage and Permeability: Well drained. Runoff is slow or medium due to highly permeable A horizons and grass vegetation. Permeability is moderate to moderately slow.

Use and Vegetation: Essentially all areas grow wild grass and scattered pine tree vegetation in the southern part of Korea whereas pine forest is in the northeast. Few areas are cultivated.

Distribution and Extent: A small extent occurs throughout the country on mountain crests chiefly above 600 meters. These soils are believed to occur on southern remnants of the Gaema Plateau which is extensive in North Korea.

Series Established: Dalseong Gun, Gyeongsangbug Do, 1967.

Remarks: The Mangsil series is an Acid Brown Forest soil as classified in Japan. The concentration of clay in the surface horizon is not considered as representative for the series.

Mangsil Series Contd.

Lab. Nos. T155-160 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture — VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International — CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 10	A11	0.3		3.4		2.4	1.3	56.6	36.3	SiCL	4.0	26.7	33.0	LiC
10- 25	A12	0.3		2.4		1.8	1.0	64.4	30.4	SiCL	2.9	11.7	55.0	SiC
25- 40	A3	0.0		2.2		1.8	1.3	63.4	31.3	SiCL	2.6	14.0	52.1	SiC
40- 52	B1t	0.3		2.2		1.6	1.0	58.8	36.4	SiCL	2.6	10.0	51.0	SiC
52- 90	B2t	0.2		2.9		2.0	1.3	57.1	36.7	SiCL	3.4	9.4	50.5	SiC
90-150	B3	0.4	8.3		9.1	10.5	6.2	48.9	17.0	L	20.0	26.7	36.3	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Atterberg Limits % LL	PI	pH H2O (1:1)	1 N KCl	O.M. %	Avail P_2O_5 ppm	2/ CEC	Extractable Cations (me/100g) Ca	Mg	Na	K	H
	58.9	32.6	-	-	4.5	3.9	12.20	19	20.1	1.30	0.70	0.10	0.38	-
	49.0	26.0	58	11	5.0	4.0	7.16	7	15.2	0.70	0.20	0.04	0.14	-
	60.0	31.9	67	13	4.8	4.0	9.68	10	15.1	0.30	0.20	0.05	0.20	-
	34.1	18.7	-	-	5.0	4.0	1.16	-	9.5	0.20	0.20	0.08	0.13	-
	28.8	17.6	42	11	5.0	3.8	1.16	-	10.8	0.30	0.30	0.18	0.18	-
	31.0	12.2	37	7	5.4	3.7	0.30	-	8.9	0.60	0.80	0.10	0.18	-

Base Saturation % CEC	Sum of Cations	Elemental Analysis of Clay SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	3/ CEC me/100g
12.3	-	3.54	57.99	5.97	24.00	2.34	46.05
7.1	-	-	-	-	-	-	-
5.0	-	2.56	50.52	10.03	27.15	-	51.55
6.4	-	-	-	-	-	-	-
8.9	-	2.19	46.08	9.63	29.52	2.02	37.03
18.9	-	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, 1 N NaCl Extracted

Established Series
UKT, JFD
18 November, 1969

MANGYEONG SERIES

The Mangyeong series is a member of the coarse silty, mixed, nonacid, mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick gray to dark grayish brown silt loam Apg horizons and moderately deep mottled yellowish brown and gray silt loam cambic B horizons. Cg horizons are dark gray or greenish gray silt loam with few or no mottles. Mangyeong soils are on broad level fluvio-marine plains and are derived from very deep coarse silty sediments.

Typifying Pedon: Mangyeong silt loam - paddy rice (Field description Gimje Gun profile No. 103; colors are for moist soil.)

Ap1g -- 0 to 10 cm. Gray (5Y 5/1) silt loam; common fine distinct brown to dark brown (7.5YR 4/4) mottles; puddled; dries and breaks to weak medium granular structure; friable, slightly sticky and slightly plastic; many fine white mica; many fine and medium roots; abrupt smooth boundary; pH 5.5.

Ap2g -- 10 to 21 cm. Gray (5Y 5/1) silt loam; common medium and coarse distinct yellowish brown (10YR 5/6) and brown to dark brown (7.5YR 4/4) mottles; weak coarse platy structure; firm, slightly sticky and slightly plastic; many fine white mica; few fine vertical tubular pores; many fine roots; abrupt smooth boundary; pH 6.0.

B1g -- 21 to 70 cm. Gray (5Y 5/1) silt loam; common medium and coarse distinct strong brown (7.5YR 5/6) mottles; crushed color light olive brown (2.5Y 5/4); weak coarse prismatic structure breaking to weak coarse blocky; slightly sticky and slightly plastic; common medium and coarse pores; many fine white mica; few fine roots; clear smooth boundary; pH 8.0.

B2 -- 70 to 86 cm. Grayish brown (2.5Y 5/2) very fine sandy loam; common prominent strong brown (7.5YR 5/6), yellowish red (5YR 4/6) and brown to dark brown (10YR 4/3) mottles; crushed color brown (10YR 5/3); weak coarse prismatic structure breaking to weak fine platy; thin continuous gray (2.5Y 5/2) exprism cutans; slightly sticky and nonplastic; many medium and fine mica; few medium pores; no roots; clear smooth boundary; pH 8.5.

C1g -- 86 to 125 cm. Gray (5Y 5/1) silt loam to very fine sandy loam; mottles as above; structureless (massive); firm, slightly sticky and nonplastic; few very coarse pores; abrupt wavy boundary; pH 8.5.

C2g -- 125 to 170 cm. Dark greenish gray (5GY 4/1) very fine sandy loam; structureless (massive); less firm than above; slightly sticky and slightly plastic; no mottles; pH 8.5.

C3g -- 170 to 220 cm. Dark greenish gray (10GY 4/1) silt loam; structureless (massive); firm, slightly sticky and slightly plastic.

Type Location: Gimje Gun, Jeollabug Do, about 200 meters east of Eunpo Ri, Gwanghwal Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to bedrock is probably more than 5 meters. The clay content is less than 18 percent and less than 15 percent is coarser than very fine sand. Base saturation is commonly more than 60 percent. Reaction is strongly to medium acid in the A and mildly to moderately alkaline in the B and Cg horizons. Common to many fine white and yellow mica occur throughout the profiles. Apg horizons are 20 to 30 cm. thick dark grayish brown, grayish brown, light brownish gray, light gray or gray silt loam or loam with mottles. Cambic B horizons are dominantly mottled gray, dark grayish brown, grayish brown, light olive gray, olive gray or dark gray and strong brown, yellowish brown, yellowish red or brown to dark brown silt loam, loam, very fine sandy loam or silt with prismatic structure. The Cg horizons are dark gray, greenish gray or very dark gray silt, silt loam, loam or fine sandy loam with massive structure and few or no mottles.

Competing Series and Their Differentiae: These are the Gwanghwal, Jeonbug, Ihyeon, Gyuam, Honam and Gimhae series. The Gwanghwal soils have grayer colors and contain toxic salt from the sea. The Jeonbug soils have fine silty textures. The Ihyeon and Gyuam soils have browner colors, deeper water tables and occur on continental alluvial plains. The Honam soils have fine clayey textures, more acid reaction and occur on low continental river terraces. The Gimhae soils have fine silty textures, grayer colors and extremely acid reaction when dry.

Setting: The Mangyeong soils are on level to nearly level fluvio-marine plains and are derived from stratified coarse silty fluvio-marine materials. Dominant slopes are about 0.5 percent and the range is from 0 to 2 percent.

Principal Associated Soils: The Gwanghwal, Jeonbug, and Jisan are among the soils associated with the Mangyeong soils. The Gwanghwal soils occur adjacent to the sea while the Jeonbug soils are in physiographic positions similar to the Mangyeong soils. The Jisan soils are in local upland valley alluvium which is sometimes adjacent to the Mangyeong soils.

Drainage and Permeability: Poorly drained. Permeability is very slow. Runoff is artificially controlled as all areas are terraced and dyked for paddy rice land use. The artificial water table generally is about 75 cm. or below.

Use and Vegetation: Most areas are used for rice during wet seasons and about one half is used for barley during dry winter and spring seasons.

Distribution and Extent: The Mangyeong soils are of large extent in the plains of the country.

Series Established: Gimje Gun, Jeollabug Do, 1967.

Remarks: The drainage of this series was considered as imperfect before placement in the new classification system because double crops can be grown.

Lab. Nos. Dm185-191 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	Ap1g	0.4	—	1.0	—	1.5	10.0	75.7	11.8	SiL	1.3	61.7	25.2	L
10- 21	Ap2g	0.0	—	1.8	—	2.2	12.5	71.1	12.4	SiL	2.3	59.7	25.6	L
21- 70	B1g	0.0	—	0.2	—	3.0	18.8	64.9	13.1	SiL	0.3	61.7	24.9	L
70- 86	B2	0.0	—	0.2	—	1.2	27.5	65.7	5.4	SiL	0.3	84.4	9.9	FSL
86-125	C1g	0.0	—	0.1	—	3.5	24.4	62.4	9.6	SiL	0.2	76.1	14.1	FSL
125-170	C2g	0.0	—	0.2	—	2.9	25.9	63.0	8.0	SiL	0.3	81.0	10.7	FSL
170-220	C3g	0.0	—	0.1	—	0.2	21.3	66.8	11.6	SiL	0.2	69.8	18.4	FSL

Moisture Retention %			Bulk	pH		O.M.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms	Density g/cc	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg me/100g	Na	K	H	CEC	Sum of Cations
44.4	25.1	7.6	1.25	4.8	4.3	1.40	9.80	2.93	2.46	0.37	0.47	0.45	63.6	93.3
41.8	27.2	7.6	1.39	5.2	4.5	1.32	11.00	3.21	2.85	0.37	0.23	0.25	66.6	96.4
37.5	27.1	7.5	1.45	7.2	5.7	1.51	12.00	2.88	5.24	0.89	0 54	0.05	79.6	99.5
37.6	14.4	5.0	-	7.9	5.9	0.25	8.00	1.22	3.49	0.92	0.59	0.05	77.6	99.2
36.1	23.2	6.6	-	7.9	6.0	0.40	11.00	1.48	4.36	0.84	0.72	0.05	67.3	99.3
36.4	19.5	5.9	-	7.9	6.5	0.20	9.80	1.22	3.11	2.08	1.32	0.05	78.9	99.4
34.5	23.7	7.1	-	8.4	6.9	0.40	13.80	0.65	2.99	0.51	1.65	0.05	42.0	99.2

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
JFD, UKT
20 November, 1969

MANSEONG SERIES

The Manseong series is a member of the fine loamy over sandy skeletal, mixed, nonacid, mesic family of Aeric Fluventic Haplaquepts (Low Humic Gley Alluvial soils). These soils have thin olive gray to dark grayish brown loam Apg horizons and moderately deep yellowish brown silt loam cambic B horizons with gray mottles. The Cg horizons are light olive gray very gravelly sand. The Manseong soils developed on continental alluvial plains and fan terraces from mixed alluvial materials.

Typifying Pedon: Manseong loam - paddy rice (Field description Damyang Gun profile No. 30; colors are for moist soil.)

Ap1g -- 0 to 12 cm. Olive gray (5Y 4/2) loam; few fine to medium prominent dark yellowish brown (10YR 4/4) mottles; puddled structure, dries and breaks to weak fine or medium granular; friable, slightly sticky and slightly plastic; few fine random interstitial pores, many fine rice roots; clear smooth boundary; pH 5.3.

Ap2g -- 12 to 18 cm. Olive gray (5Y 4/2) silt loam; many medium and coarse prominent reddish brown (5YR 5/4) and yellowish brown (10YR 5/4) exped mottles; crushed color olive brown (2.5Y 4/4); weak coarse platy structure; many fine vertical pores and roots; clear wavy boundary; pH 5.8. No samples collected.

B -- 18 to 52 cm. Prominently mottled yellowish brown (10YR 4/6) and olive gray (5Y 5/2) silt loam; crushed color light olive brown (2.5Y 5/4); weak coarse prismatic structure breaking to weak coarse blocky; firm, slightly sticky and slightly plastic; few fine living rice roots; abrupt smooth boundary; pH 6.3.

C1g -- 52 to 70 cm. Light olive gray (5Y 6/2) very gravelly sand; common coarse prominent strong brown (7.5YR 5/6) mottles; structureless (single grain); loose, nonsticky and nonplastic; about 40 percent unweathered subangular cobble and gravel; gradual wavy boundary; pH 6.7.

C2g -- 70 to 120 cm. Light olive gray (5Y 6/2) very gravelly sand; structureless (single grain); loose, nonsticky and nonplastic; pH 6.7.

Type Location: Damyang Gun, Jeollanam Do, 150 meters south of Manseong bridge, Damyang Eup.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is 2 to 5 meters or more. Base saturation is generally more than 60 percent. Reaction is medium to slightly acid. Apg horizons are 10 to 20 cm. thick, olive gray, gray, olive, grayish brown or light olive loam or silt loam with mottles. Cambic B horizons, between 50 and 100 cm. thick, have at least one horizon with matrix color chroma of 3 or more. They may be yellowish brown or dark yellowish brown with gray mottles or prominently mottled yellowish brown and grayish brown, dark grayish brown, olive gray, dark gray silt loam, loam or silty clay loam. Cg horizons are light olive gray, gray, dark gray, grayish brown or olive gray very gravelly or very cobbly loamy sand or sand with few mottles.

Competing Series and Their Differentiae: These include the Sinheung, Yeongsan, Hagsan, Tongcheon, Seoggye and Subug series. The Hagsan, Tongcheon and Seoggye soils have browner colors and are moderately well drained. The Sinheung soils have deep fine loamy textures. The Yeongsan soils have fine loamy over sandy textures. The Subug soils have coarse loamy over sandy skeletal textures, grayer colors and lack cambic B horizons.

Setting: The Manseong soils are on nearly level and very gently sloping flood plains and fan terraces. Slopes are dominantly about 1 percent and range from 0 to 4 percent.

Principal Associated Soils: These are the Hwangryong, Hagsan, Tongcheon, Sindab, Subug and Bonryang series. The Hwangryong soils have sandy skeletal textures and excessive drainage. The Sindab soils have sandy textures and poor drainage. The Bonryang soils have coarse loamy over sandy textures, brown colors and are well drained.

Drainage and Permeability: The Manseong soils are imperfectly drained and moderately rapidly permeable. The runoff is very slow as all areas are level terraced for rice paddy land use.

Use and Vegetation: These soils are used for flood irrigated rice during the wet summers and non-irrigated barley during dry winter and spring seasons.

Distribution and Extent: The Manseong soils are of small extent and are distributed along streams throughout the country.

Series Established: Damyang Gun, Jeollanam Do, 1966.

Remarks: Some gravel was discarded from the samples collected for the typifying pedon.

Lab. Nos. Ee112-115 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori-zon	Gra-vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 12	Ap1g	2.9	0.6	1.4	6.0	21.8	17.6	40.1	12.5	L	10.9	50.8	25.8	L
12- 18	Ap2g	-	-	-	-	-	-	-	-	-	-	-	-	-
18- 52	B	0.4	2.4	2.6	4.0	5.9	7.6	58.7	18.8	SiL	9.7	29.9	41.6	CL
52- 70	C1g	44.3	11.1	22.7	38.0	11.1	2.9	9.1	5.1	S	75.3	14.4	5.2	LS
70-120	C2g	10.9	2.8	15.2	51.8	19.8	1.9	6.4	2.1	S	77.0	18.4	2.5	S

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
	39.5	11.2	5.3	4.1	2.74	7.45	2.52	0.65	0.15	0.10	1.05	45.9	76.5
	-	-	-	-	-	-	-	-	-	-	-	-	-
	35.1	16.2	6.3	4.7	1.11	8.20	4.50	1.20	0.15	0.08	0.05	72.3	99.2
	9.5	4.1	6.7	5.0	0.10	2.10	0.92	0.32	0.12	0.05	0.05	48.5	96.3
	6.5	2.4	6.7	4.9	0.10	-	-	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

MARYEONG SERIES

The Maryeong series is a member of the coarse loamy, mixed, mesic family of Aquic Udifluvents (Alluvial soils). These soils have moderately thick dark reddish brown Ap horizons in natural condition and brown to dark brown gravelly loam Ap horizons with few mottles in rice paddy. C horizons are deep dark reddish brown gravelly sandy loam with gray ground water table mottles beginning between 50 and 100 cm. depths. They are developed in narrow valley alluvial plains in materials washed from reddish shale and sandstone soils.

Typifying Pedon: Maryeong loam - rice paddy (Field description, Imha Reservoir Survey, profile No. 4; colors are for moist soil.)

Ap1 -- 0 to 10 cm. Brown to dark brown (7.5YR 4/2) loam; structureless (massive); friable, slightly sticky and slightly plastic; many fine rice roots; abrupt smooth boundary.

Ap2 -- 10 to 30 cm. Dark reddish brown (5YR 3/3) gravelly loam; weak medium to coarse platy and blocky structure; common fine to medium faint strong brown (7.5YR 5/8) mottles; firm, slightly sticky and slightly plastic; about 15 percent slightly weathered mixed reddish brown shale and sandstone gravel; few fine pores; few fine roots; abrupt smooth boundary.

C1 -- 30 to 80 cm. Dark reddish brown (5YR 4/4) gravelly sandy loam; few fine faint strong brown (7.5YR 5/8) and grayish brown (2.5Y 5/2) mottles; structureless (massive); few fine pores; about 15 percent gravel as above; no roots; abrupt smooth boundary.

C2 -- 80 to 120 cm. Dark reddish brown (5YR 4/4) to yellowish brown (10YR 5/4) gravelly sandy loam; common fine faint very dark brown (10YR 2/2) and few fine faint grayish brown (10YR 5/2) mottles; structureless (massive); firm, slightly sticky and slightly plastic; about 10 percent slightly weathered mixed gravel and cobbles.

Type Location: Andong Gun, Gyeongsangbug Do, about 200 meters south of Maryeong Dong, Imdong Myeon.

Range in Characteristics: Soil depth is more than 100 cm. and depth to hard rock is probably more than 3 meters. Base saturation is more than 60 percent. Reaction is slightly acid to neutral. 10 to 35 percent slightly weathered reddish brown shale and sandstone gravel, fragments and some cobbles occur and generally increase with depth. Ap horizons, 15 to 30 cm. thick, are brown to dark brown, reddish brown or dark reddish brown gravelly loam, silt loam or fine sandy loam. Farmers generally remove most gravel from this horizon in paddy fields. C horizons are dark reddish brown, reddish brown, brown, weak red or reddish gray gravelly sandy loam, loam or silt loam with few or common fine grayish brown water table mottles beginning between 50 and 100 cm. and increasing with depth.

Competing Series and Their Differentiae: These include the Tongcheon, Samam, Sachon, Yongji and Jisan soils. The Tongcheon soils have loamy skeletal textures and more yellow colors. The Samam soils have fine loamy textures and contain less gravel. The Sachon soils have grayer colors, are imperfectly drained and are derived from granitic materials. The Yongji soils have fine loamy textures, more yellow colors, contain no gravel and occur in granitic areas. The Jisan soils have gray colors, poor drainage, fine loamy textures and occur in granitic areas.

Setting: The Maryeong soils occur on nearly level to very gently sloping narrow valley alluvial plains in materials washed mostly from reddish brown shale and sandstone upland soils. Dominant slopes are about 1.0 percent and the range is from zero to 3.0 percent.

Principal Associated Soils: The Tongcheon, Hwangryong, Samam, Imdong, Habin and Buyeo soils are associated. The Tongcheon, Samam and Hwangryong soils occur in somewhat similar physiographic positions. The Hwangryong soils have sandy skeletal textures, excessive drainage and occur adjacent to river channels. The Imdong soils are well drained and occur in local alluvial foot slope and fan positions between the Maryeong soils on alluvial plains and the Habin and Buyeo soils in residual upland positions.

Drainage and Permeability: Moderately well drained. Permeability is moderate and runoff is slow or very slow due to leveled terraces and dykes constructed for rice paddy land use.

Use and Vegetation: Most areas are used for paddy rice during wet summer and barley during dry winter periods.

Distribution and Extent: The Maryeong soils are of small extent and are distributed mainly in the southeastern part of the country.

Series Established: Andong Gun, Gyeongsangbug Do, 1969.

Remarks: The Maryeong and associated soils in areas of reddish brown shales and sandstone have less gray colors than equally wet soils formed in other parent materials.

Lab. Nos. Nd18-21 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	Ap1	9.4	2.1	6.1	14.7	15.2	10.2	40.2	11.5	L	25.4	40.4	22.7	SL
10- 50	Ap2	11.9	0.8	4.4	12.4	16.6	10.3	41.9	13.6	L	19.7	44.2	22.5	L
50- 80	C1	18.2	4.1	10.4	26.3	23.2	8.2	22.2	5.6	SL	45.3	38.2	10.9	CoSL
80-120	C2	13.9	3.2	7.0	22.6	17.0	14.6	29.2	6.4	SL	36.9	41.5	15.2	FSL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
						me/100g							
			6.6	5.3	2.23	8.60	7.37	2.00	0.23	0.25	-	112	-
			6.6	5.3	1.09	7.30	6.50	1.87	0.15	0.12	-	118	-
			7.0	5.1	0.43	6.10	5.37	1.52	0.10	0.12	-	116	-
			7.1	5.2	0.53	6.70	6.00	1.75	0.08	0.12	-	118	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

MITAN SERIES

The Mitan series is a member of the clayey skeletal, mixed, nonacid, mesic family of Dystric Eutrochrepts (Regosols). These soils have moderately thick dark brown channery angular cobbly silty clay loam A horizons and moderately deep brown to dark brown very channery to very angular cobbly silty clay loam cambic B horizons. The C horizons are brown very channery to very angular cobbly silty clay loam or silt loam colluvium derived from limestone materials in mountainous regions.

Typifying Pedon: Mitan very channery silty clay loam - corn (Field description Pyeongchang Gun profile No. 102; colors are for moist soil.)

Ap -- 0 to 13 cm. Dark brown (7.5YR 3/2) very channery clay loam; moderate fine and medium granular structure; friable, sticky and plastic; many fine to medium living roots; approximately 50 percent unweathered limestone fragments; most large fragments have been removed from the A horizons in the cultivated areas by farmers; abrupt smooth boundary; pH 8.0.

B -- 13 to 70 cm. Brown to dark brown (7.5YR 4/4) very channery to very angular cobbly clay loam; weak medium subangular blocky structure partly breaking to moderate medium granular; friable, sticky and plastic; approximately 60 percent small limestone fragments; few fine living roots; gradual wavy boundary; pH 8.0.

C -- 70 to 110 cm. As above with weak medium and fine granular structure, more and larger coarse fragments than above; pH 8.0.

Type Location: Pyeongchang Gun, Gangweon Do, about 2 km. east of Pyeongchang bridge, Sang Ri, Pyeongchang Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to bedrock is more than 150 cm., probably ranging to several meters. Base saturation is commonly 60 percent or more in the control section. Reaction is neutral to mildly alkaline. The content of coarse limestone fragments ranges from 35 to 90 percent by volume with about 40 to 75 percent channery and angular cobbly fragments dominating. A horizons are 20 to 30 cm. thick, brown to dark brown, very dark brown, very dark grayish brown and sometimes black silt loam, silty clay loam, clay loam or loam. In most older cultivated areas the large angular cobbly and stone fragments have been removed from the A horizon by farmers and piled at the edge of the fields, in stone walls, terraces or buried. The cambic B horizons between 50 and 100 cm. are brown, dark brown, very dark brown or dark yellowish brown angular cobbly silty clay loam, clay loam or light clay. The clay content ranges from about 35 to 60 percent. The C horizons are brown to dark brown, strong brown or dark yellowish brown angular cobbly silty clay loam, loam or silt loam.

Competing Series and Their Differentiae: These are the Ungyo, Iweon, Pyeongan, Seogto, Gaghwa, Hogye, Imog and Maji series. The Ungyo soils have strongly to medium acid reaction, low base saturation and are derived from granitic soils. The Iweon soils have lighter colors, lower base saturation, coarse loamy textures and are derived chiefly from granitic materials. The Pyeongan soils have argillic B horizons and redder colors throughout the solum. The Seogto soils are similar to the Mitan soils except for having loamy skeletal textures, low to medium base saturation, strongly acid to medium reaction and in being derived from acidic crystalline materials. The Gaghwa soils are in the fine clayey texture family, have redder colors, argillic B horizons and low base saturation. The Hogye soils are in the loamy skeletal texture family and are developed on alluvial fans, fan terraces and in some local valley alluvium derived from acidic and intermediate parent materials. The Imog soils have coarse loamy textures. The Maji soils belong to the loamy skeletal texture family and occur on alluvial fans, fan terraces and foot slope positions in alluvium derived from limestone and related materials.

Setting: The Mitan soils are formed in channery, angular cobbly and stony colluvial and alluvial-colluvial materials in mountain valleys, coves and footslope positions in areas of limestone geology. Slopes range from about 7 to 60 percent with 15 to 30 percent dominating.

Principal Associated Soils: The Pyeongchang and Jangseong soils are associated in residual positions on higher slopes while the Maji soils occur in alluvial-colluvial positions below the Mitan soils on more gentle slopes where coarse fragments are usually smaller in size. The Pyeongchang soils have red colors and clay textures while the Jangseong soils are shallow over hard limestone bedrock.

Drainage and Permeability: Well drained. Permeability is moderate or moderately rapid. Surface runoff is slow or moderately slow becoming rapid after saturation.

Use and Vegetation: Most areas are used for corn, barley, soybean, radish, cabbage, bean and similar crops. Some of the steeper and more stony areas grow pine and mixed forest species.

Distribution and Extent: The Mitan series is of small extent and occurs in the limestone areas in the northeastern part of the country.

Series Established: Pyeongchang Gun, Nov. 1968.

Remarks: The Mitan soils in limestone areas occupy landscape positions more or less equivalent to the Seogto soils in granitic areas. Coarse fragments in the A horizon of the typifying pedon are more numerous than typical for cultivated areas and the base saturation is lower than typical.

Lab. Nos. Mh235-236 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori-zon	Gra-vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0-13	Ap	64.8	4.1	4.4	3.1	2.5	4.5	42.9	38.5	SiCL	12.0	22.7	26.8	LiC
13-70	B	81.2	1.6	1.9	2.3	2.8	4.4	51.8	35.2	SiCL	6.2	23.7	34.9	LiC

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg me/100g	Na	K	H	CEC	Sum of Cations
33.5	27.2	14.1	7.9	6.7	1.56	6	27.50	6.90	3.70	0.10	0.35	0.05	40.8	99.5
31.5	25.9	-	7.8	6.7	0.97	5	-	-	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KBJ, JFD
16 October, 1969

MUDEUNG SERIES

The Mudeung series is a member of the fine loamy, mesic family of Lithic Dystrochrepts (Lithosols). These soils are shallow with thin brown to dark brown gravelly silt loam or loam A horizons, moderately thick brown silt loam cambic B horizons over hard acidic crystalline bedrock materials. This series occurs in hilly and mountainous areas.

Typifying Pedon: Mudeung gravelly silt loam - pine forest (Modified field description Gimhae Gun, profile No. 80; colors are for moist soil.)

A -- 0 to 15 cm. Brown to dark brown (10YR 4/3) gravelly silt loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; many fine roots; about 10 percent andesite porphyry gravel; clear smooth boundary.

B -- 15 to 27 cm. Brown to dark brown (10YR 4/3) gravelly loam; weak medium subangular blocky structure, breaking readily to fine to medium granular; friable, slightly sticky and slightly plastic; common fine roots; clear wavy boundary.

C -- 27 to 40 cm. Pale brown and light yellowish brown materials weathered from andesite porphyry; loamy textured, with rock structure.

R -- 40 cm. Hard andesite porphyry bedrock.

Type Location: Gimhae Gun, Gyeongsangnam Do, about 2 km. northwest from the Gimhae engineering school, Gimhae Eub.

Range in Characteristics: The soil depth over medium hard bedrock ranges between 30 and 50 cm. averaging about 20 cm. of A horizon and 20 cm. of B horizon. Bedrock outcrops may or may not occur. Reaction is commonly strongly to medium acid throughout. The base saturation is less than 60 percent. A horizons are brown to dark brown, but where eroded they are yellowish brown to dark yellowish brown, generally gravelly silt loam, loam and very fine sandy loam. Commonly 7 to 20 percent gravel and some angular cobbles and stones occur throughout the A horizons. The cambic B horizons are less brown, more yellow, contain slightly more clay and have weak blocky structure. R is hard non micaceous acidic crystalline materials.

Competing Series and Their Differentiae: These are the Daegu, Jeongja, Habin and Samgag soils. The Daegu soils are developed from shale materials, contain somewhat more silt andhave higher base saturation. The Jeongja soils have somewhat finer textures and redder colors. The Habin soils have redder colors and are developed from red shale materials. The Samgag soils have coarse loamy textures and very thick micaceous saprolite.

Setting: The Mudeung soils occur on moderately steep and very steep hilly and mountainous areas where underlain by andesite porphyry and granite porphyry. Slopes are dominantly 30 to 60 percent and range from 7 to 60 percent or more.

Principal Associated Soils: Daegu, Taehwa, Ulsan and Bonggye series are associated in similar positions. Rockout crop and talus are also associated. The Banho, Seogto, Gaghwa and Jangweon soils occur on foot slopes below the Mudeung soils.

Drainage and Permeability: The Mudeung soils are somewhat excessively drained and moderately permeable. The runoff is rapid or very rapid after profile saturation according to slope gradient.

Distribution and Extent: The Mudeung soils are of large extent and are distributed throughout the country in mountainous areas where andesite porphyry and similar geology occurs.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Remarks: The typifying pedon colors are darker and the organic matter content is higher than normal as most areas are eroded.

Lab. Nos. G1146-147 **Typifying Pedon**

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0-15	A	13.3	4.0	4.8	4.3	3.5	6.5	56.9	20.0	SiL	13.9	25.2	40.9	CL
15-27	B	11.6	2.4	4.1	4.3	4.8	5.5	53.8	25.1	SiL	11.6	23.9	39.4	LiC

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations me/100g Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
37.9	29.6	12.3	5.7	4.0	2.81	6	10.30	1.90	1.15	0.10	0.18	1.66	32.3	66.7
42.2	29.5	12.9	5.5	3.9	1.66	6	10.00	0.50	0.70	0.18	0.13	3.32	15.1	31.3

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

MUI SERIES

The Mui series is a member of the coarse loamy, mixed, mesic family of Umbric Dystrochrepts (Regosols). These soils have moderately thick dark or very dark brown stony loam A horizons and moderately deep strong brown stony sandy loam cambic B horizons. The C horizons are strong brown cobbly and stony fine sand, loamy sand or sandy loam. They are developed in very deep mountain colluvium derived from granitic materials.

Typifying Pedon: Mui stony loam - radish (Field description Pyeongchang Gun profile No. 122; colors are for moist soil.)

Ap -- 0 to 17 cm. Dark brown (10YR 3/3) stony loam; moderate fine and medium granular structure; friable, slightly sticky and slightly plastic; many medium to coarse interstitial pores; few coarse worm holes; about 20 percent unweathered granitic stones, gravel and cobbles; common fine yellowish mica; abundant fine and medium roots; abrupt smooth boundary; pH 4.8.

B1 -- 17 to 61 cm. Strong brown (7.5YR 5/6) stony light sandy clay loam; weak medium and coarse subangular blocky structure breaking to moderate medium and coarse granular; firm, slightly sticky and slightly plastic; common fine and medium to coarse continuous simple tubular pores; few medium worm holes; about 15 percent unweathered subangular granitic stones, gravel and cobbles; mica as above; few fine roots; gradual wavy boundary; pH 5.0.

B2 -- 61 to 120 cm. Strong brown (7.5YR 5/6) stony sandy loam; weak medium subangular blocky structure breaking readily to moderate granular; friable, slightly sticky and nonplastic; about 10 percent unweathered granitic stones, gravel, cobbles and boulders; few roots; diffuse irregular boundary; pH 5.0.

C1 -- 120 to 150 cm. Strong brown (7.5YR 5/6) fine sand; structureless (single grain); very friable, nonsticky and nonplastic; coarse fragments increasing with depth.

Type Location: Pyeongchang Gun, Gangweon Do, about 300 m. west of Yagsu Dong, Jinbu Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. Depth to bedrock is more than 2 meters probably ranging to about 6 meters. Most areas have from 10 to 35 percent angular and subangular granitic gravel, stones and cobbles on the surface and throughout the profile generally increasing in size and amount with depth. Boulders may occur. Farmers generally remove the larger coarse fragments from cultivated layers. Reaction is strongly to medium acid and the base saturation is medium to low. A horizons are 15 to 30 cm. thick, dark brown, very dark brown, very dark grayish brown or black stony loam, sandy loam or very fine sandy loam with more than 1.0 percent organic matter. Average thickness is about 20 cm. The cambic B horizons are strong brown, brown, dark yellowish brown or yellowish brown stony, cobbly and gravelly sandy loam, fine sandy loam, loam or light sandy clay loam. Clay content of the cambic B horizons is less than 18 percent. The C horizons are somewhat stratified yellowish brown, dark yellowish brown, strong brown or yellow sand, loamy sand or sandy loam with varying amounts of slightly weathered granitic stone, cobble, gravel and boulders.

Competing Series and Their Differentiae: These are the Iweon, Weondang, Mitan, Imog, and Seongsan soils. The Iweon and Seongsan soils lack dark colored epipedons. The Weondang soils lack dark A horizons and have red or yellowish red colors. The Mitan soils belong to the clayey skeletal texture family, are neutral to alkaline in reaction and are derived from limestone materials. The Imog soils lack dark epipedons and are free of stones and cobbles.

Setting: The Mui soils are formed in stony coarse loamy mountain colluvium in granitic areas with cool humid climate. Frost free days are approximately 170 to 180. Slopes range from 2 to 30 percent and the dominant slopes are 15 to 30 percent.

Principal Associated Soils: These are the Imog, Chahang and Weoljeong series. The Imog soils occur in local alluvial positions while the Chahang and Weoljeong soils occur in residual positions above the Mui soils.

Drainage and Permeability: Well drained. Permeability is probably moderate or rapid and runoff is probably slow due to rapid permeability.

Use and Vegetation: Most areas are cultivated for crops such as corn, soybean, barley, radish, cabbage and red pepper. Only a very small extent is used for rice paddy. Some areas are used for house sites and a limited extent grows pine and mixed forest.

Distribution and Extent: The Mui soils are of limited extent and occur in the high mountain valleys in the northeastern part of the country.

Series Established: Pyeongchang Gun, Gangweon Do, November 1968.

Remarks: The Mui soils are more or less equivalent to the Iweon soils except for having a dark surface layer.

Lab. Nos. Mh290-293 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 17	Ap	14.7	7.1	10.5	11.6	10.5	6.5	35.8	17.2	L	31.6	29.7	21.5	CL
17- 61	B1	13.1	3.1	8.2	16.5	8.8	15.9	31.8	15.7	SL	30.5	33.0	20.8	CL
61-120	B2	12.9	3.3	10.1	20.9	18.1	8.5	25.8	13.3	SL	37.7	31.9	17.1	SL
120-150	C1	7.9	3.0	12.3	38.8	24.8	7.5	10.7	2.8	S	59.6	31.1	6.5	LCoS

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	CEC 2/	Extractable Cations Ca	Mg	Na	K	H (me/100g)	Base Sat. % CEC	Sum of Cations
41.6	33.1	11.9	4.5	3.6	6.55	243	7.15	0.80	0.20	0.03	0.38	4.33	19.7	24.6
29.6	23.0	9.8	5.5	3.9	0.77	26	5.00	1.10	0.80	0.15	0.10	2.20	43.0	49.4
25.8	19.8	8.0	5.5	3.9	0.72	23	3.80	1.25	0.35	0.13	0.10	1.85	48.2	49.7
16.6	12.5	4.8	5.3	3.9	0.26	90	2.30	0.65	0.00	0.15	0.08	1.80	38.3	32.8

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established ~~Series~~
UKT, JFD
22 November, 1969

MYEONGJI SERIES

The Myeongji soils are member of the mixed, mesic, sandy family of Aquic Fluventic Hapludolls (Alluvial soils). They have thick very dark grayish brown sand Ap horizons, very pale brown sandy C1 horizons and light brownish gray Cg horizons. They are developed on continental river deltas.

Typifying Pedon: Myeongji loamy fine sand - onion (Field description Gimhae profile No. 16; colors are for moist soil.)

Ap1 -- 0 to 15 cm. Very dark grayish brown (10YR 3/2) loamy fine sand; weak fine granular structure; loose, nonsticky and nonplastic; common fine to medium sea shells; common fine onion roots; gradual smooth boundary; pH 8.0.

Ap2 -- 15 to 40 cm. Very dark gray to very dark grayish brown (10YR 3/1.5) loamy fine sand; weak fine granular structure; loose, nonsticky and nonplastic; few fine onion roots; sea shells as above; abrupt smooth boundary; pH 8.0.

C1 -- 40 to 68 cm. Mottled very pale brown (10YR 7/4), brownish yellow (10YR 6/8) and olive brown (2.5Y 4/4) fine sand; crushed color yellowish brown (10YR 5/4); structureless (single grain); loose, nonsticky and nonplastic; clear wavy boundary; pH 8.0.

C2g -- 68 to 110 cm. Light brownish gray (2.5Y 5/2) fine sand; structureless (single grain); loose, nonsticky and nonplastic; pH 8.0.

Type Location: Gimhae Gun, Gyeongsangnam Do, about 100 meters east of Sangsin Ri, (Sinjeong village) Myeongji Myeon.

Range in Characteristics: Soil depth is more than 200 cm. and probably ranges to more than 5 meters. Base saturation is more than 60 percent throughout the profiles. Reaction is neutral to mildly alkaline. Sea shells occur throughout the profile though they are concentrated in the A horizons. Wind blown sea water may occur on these soils, but due to rapid leaching, does not normally adversely affect the choice of plants. Clay content is less than 15 percent in the solum. The Ap or A horizons are 30 to 50 cm. thick, very dark grayish brown, very dark gray, very dark brown or dark brown fine sand, loamy fine sand or sandy loam with common sea shells. C1 horizons, between 50 and 100 cm. thick, are variably brown, olive brown, pale brown, brownish yellow fine sand or loamy fine sand with common sea shells. C2g horizons are light brownish gray, light gray or dark gray stratified fine sand or loamy fine sand with few or no mottles.

Competing Series and Their Differentiae: These are the Hwabong, Nagdong, Hwangryong, Jungdong and Sadu soils. All of these soils have lighter A horizon colors. The Hwabong soils have coarser sandy textures, deep water tables and occur along continental rivers. The Nagdong soils have deeper water tables and occur along continental rivers. The Hwangryong soils have sandy skeletal textures and occur along continental rivers. The Jungdong soils have coarse loamy textures and occur on continental river alluvial plains. The Sadu soils have slightly to medium acid reaction and more strongly stratified C2 horizons.

Setting: The Myeongji soils are known to occur only on flat or nearly level broad delta alluvial plains near the sea. Dominant slopes are about 1 percent and the range is from 0 to 2 percent.

Principal Associated Soils: The Myeongji soils are associated with the Haecheog and Sadu soils and with Tidal Flats. The Haecheog soils have fine silty over coarse loamy textures, grayer colors, very poor drainage and horizons which become extremely acid when dried.

Drainage and Permeability: Moderately well drained and rapidly permeable. Runoff is largely artificially controlled.

Use and Vegetation: Most of this soil is used for leek, onion, spinach, cabbage, barley, potatoe and similar vegetable crops.

Distribution and Extent: This series is of small extent and occurs on river deltas near the sea.

Series Established: Gimhae Eup, Gimhae Gun, Gyeongsangnam Do.

Remarks: Wind blown sea water sometimes deposits salt on the Myeongji soils, but because of too rapid permeability, the salt readily leaches and does not present prolonged toxicity problems.

Myeongji Series Contd.

Lab. Nos. G1166-169 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	Int. CS 2-.2	Int. FS .2-.02	Int. Silt .02-.002	Int. Textural Class
			Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture								International			
0- 15	Ap1	2.1		21.4		66.2	4.4	6.4	1.6	S	34.9	60.2	3.3	S
15- 40	Ap2	1.3		22.4		61.2	9.2	5.7	1.5	S	36.4	58.5	3.6	S
40- 68	C1	0.0		42.5		53.9	2.0	0.9	0.7	S	58.3	40.9	0.1	S
68-110	C2g	0.0		23.5		71.0	2.4	2.9	0.2	S	40.2	59.0	0.6	S

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Ca	Mg	Na	K	H
								me/100g	Extractable Cations				
15.0	8.8	3.9	1.25	6.5	5.5	1.06	261	5.50	4.90	0.50	0.12	0.12	0.05
15.0	8.8	3.7	1.49	7.5	6.3	1.06	241	5.40	5.80	9.65	0.25	0.10	0.05
6.7	3.1	1.7	1.46	7.4	6.4	0.11	88	2.20	2.15	0.45	0.40	0.05	0.05
-	-	-	-	7.5	6.2	0.11	94	2.20	2.15	0.30	0.25	0.05	0.05

Base Saturation % CEC	Sum of Cations
102.5	99.1
125.9	99.3
138.6	98.4
125.0	98.2

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

NAGDONG SERIES

The Nagdong series is a member of the sandy, mixed, mesic family of Typic Udipsamments (Alluvial soils). These soils have thin yellowish brown to brown loamy fine sand to fine sandy loam A horizons and yellowish brown loamy fine sand C horizons more than 150 cm. deep. They occur on continental river levees.

Typifying Pedon: Nagdong loamy fine sand - barley and vegetables (Field description Buyeo Gun profile No. 192; colors are for moist soil.)

Ap -- 0 to 12 cm. Yellowish brown (10YR 5/4) loamy fine sand; structureless (single grain); loose, nonsticky and nonplastic; many fine mica flakes; many fine roots; gradual smooth boundary.

C -- 12 to 120 cm. Yellowish brown (10YR 5/4) loamy fine sand; structureless (single grain); loose, nonsticky and nonplastic; many fine mica flakes.

Type Location: Buyeo Gun, Chungcheongnam Do, about 100 meters south of Baegje Bridge; east of Gum River, opposite Guuam Ri, Buyeo Eup.

Range in Characteristics: Soil depth is in excess of 150 cm. and probably ranges to 3 meters or more over any very contrasting materials. The series contains common to many fine mica flakes. Except where heavily limed, reaction ranges from extremely acid to medium acid. Base saturation is more than 60 percent. A horizons range from 10 to 20 cm. thick, brown to dark yellowish brown or yellowish brown loamy fine sand, loamy sand or fine sandy loam. C horizons are brown or yellowish brown loamy fine sand to fine sand. C horizons contain less than 18 percent clay. Minor strata of coarse sandy or silty materials may occur.

Competing Series and Their Differentiae: These are the Hwabong, Bonryang and Jungdong series. The Hwabong soils belong to the same texture family but have coarser particle sizes and less moisture holding capacity. The Bonryang series is characterized by having moderately deep coarse loamy textures over sandy textures. The Jungdong series has very fine loamy sand or very fine sand textures throughout.

Setting: The Nagdong soils occur on nearly level to very gently sloping undissected continental broad alluvial flood plain levees chiefly adjacent to river channels and on the convex side of river bends. Slopes range from 0 to 4 percent with about 1 to 2 percent gentle undulations dominating.

Principal Associated Soils: These are the Hwabong, Bonryang, Ihyeon and Gyuam soils. The Ihyeon soils have finer coarse silty textures and greater moisture holding capacity. The Gyuam soils are moderately well drained and have coarse silty textures.

Drainage and Permeability: Somewhat excessively drained. Permeability is rapid to very rapid. Runoff is slow. The water table is probably below 150 cm.

Use and Vegetation: Most areas are used for crops such as peanuts, rye and melon. Millet, buck wheat, some Chinese cabbage and poplar trees are grown in limited quanties. Only a very small extent is idle.

Distribution and Extent: The Nagdong soils are of moderate extent and occur on the larger flood plains throughout the country.

Nagdong Series Contd.

Lab. Nos. Cg195-196 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 12	Ap	0.5	0.2	0.9	8.8	42.7	24.1	17.6	5.7	LFS	13.6	73.8	6.9	LFS
12-120	C	0.0	———	6.2	———	55.3	23.7	10.6	4.2	LFS	10.4	80.8	4.6	LFS

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH: H_2O (1:1)	1 N KCl	O.M. %	Free Fe_2O_3 %	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H
17.5	10.3	3.6	1.29	4.2	3.2	0.88	0.69	4.70	1.50	1.05	0.08	0.15	1.14
12.6	9.2	3.7	-	5.9	3.8	0.36	0.68	5.20	2.90	1.05	0.03	0.03	0.14

Base Saturation %: CEC	Sum of Cations
59.1	70.9
77.1	96.6

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
9 July, 1969

NAGSEO SERIES

The Nagseo series is a member of the loamy skeletal, mixed, mesic family of Lithic Dystrochrepts (Lithosols). These soils have thin brown to dark brown channery loam A horizons and moderately thick red very channery loam cambic B horizons. Bedrock occurs within 50 cm. of the surface. They are developed mainly in residuum from schist and some gneiss in mountainous areas.

Typifying Pedon: Nagseo channery loam, eroded - pine forest (Field description Sangju Gun profile No. 207; colors are for moist soil.)

A -- 0 to 10 cm. Yellow red (5YR 4/8) channery loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; approximately 20 percent random discontinuous vesicular pores; common fine to medium white and yellow mica flakes; common fine living wild grass roots; clear wavy boundary.

B -- 10 to 30 cm. Red (2.5YR 4/6) very channery loam; moderate fine and medium granular structure; friable, slightly sticky and slightly plastic; approximately 80 percent fragments as above; few fine living grass and tree roots; abrupt irregular boundary.

R -- 30 to 40 cm. Reddish brown hard schist bedrock. Spade can cut this material with much difficulty.

Type Location: Sangju Gun, Gyeongsangbuk Do, about 4 km. south of Jungmo Middle School, near the Seonggog water reservoir; Bangae Ri, Modong Myeon.

Range in Characteristics: Depth of the Nagseo soils is about 30 cm. and ranges from 25 to 50 cm. over hard rock. Base saturation is less than 60 percent and the reaction is strongly to medium acid throughout the profile except where limed. Unweathered schist fragments comprise more than 50 percent of the control section. White and yellow mica are common. A horizons are 5 to 15 cm. thick, reddish brown or brown; when eroded they may be yellowish red and when dry reddish yellow channery or very channery loam or silt loam. Cambic B horizons are 10 to 40 cm. thick, red, reddish brown, or yellowish red very channery loam or silt loam. Occasional schist, phylite, gneiss or similar bedrock outcrops more or less even with the land surface may occur.

Competing Series and Their Differentiae: These are the Mudeung, Gwanag, Samgag, Daegu, Habin, Jangseong and Oesan soils. The Mudeung soils have more yellow colors, are free of mica and are derived from andesite porphyry. The Gwanag soils have yellowish brown colors, coarse loamy textures and granitic parent materials. The Samgag soils have coarse loamy cambic B horizons, less red colors and very thick granitic saprolite. The Daegu and Habin soils are similar except for having somewhat higher base saturation and sedimentary (shale and sandstone) parent materials. The Daegu soils have yellowish brown colors. The Jangseong soils have high base saturation, neutral reaction and are derived from limestone materials. The Oesan soils are moderately deep.

Setting: The Nagseo soils occur in residual landscape positions in hilly and mountainous areas underlain by schist and gneiss geology. Slopes range from 15 to 60 percent or more and dominant slopes are between 30 and 60 percent.

Principal Associated Soils: The Mudeung and Oesan soils are associated in similar landscape positions. The Mudeung soils are associated in adjacent andesite porphyry areas. The Oesan soils occur in landscape positions slightly less subject to erosion than the Nagseo soils.

Drainage and Permeability: Somewhat excessively drained. Permeability is probably moderate or moderately rapid and runoff is rapid.

Use and Vegetation: Most of these soils are used for forest, but small areas are used for barley, soybean, Indian millet and similar crops.

Distribution and Extent: The Nagseo soils are of rather small extent, though distributed in hilly and mountainous schist and gneiss areas throughout the country.

Lab. Nos. Fr202 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0-10	A	21.1	7.5	10.9	8.9	6.1	3.8	44.0	18.8	L	28.5	35.2	44.0	L
10-30	B													
30-40	R													

Particle Size Distribution 1/ (mm) %

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	CEC 2/	Ca	Mg	Na	K	H	Base Sat. % CEC	Sum of Cations
							me/100g							
31.3	27.3	10.3	5.2	3.9	1.53	46	6.10	0.85	0.40	0.28	0.13	2.72	26.2	37.9

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
KBJ, UKT, JFD
24 June, 1969

ODAE SERIES

The Odae series is a member of the coarse loamy, mixed, mesic family of Lithic Haplumbrepts (Rankers). These are shallow soils with moderately deep very dark brown loam A horizons and thin yellowish brown gravelly and stony sandy loam C horizons overlying hard bedrock within 50 cm. of the surface. They are developed in steep mountainous areas in residual acidic crystalline materials from rocks such as granite and granite gneiss.

Typifying Pedon: Odae rocky loam - forest (Field description Pyeongchang Gun profile No. 32; colors are for moist soil.)

O1 -- 3 to 0 cm. Mat of decomposing pine needles and twigs laced with many fine living roots.

A11 -- 0 to 12 cm. Very dark brown (10YR 2/2) rocky loam; moderate and strong fine and very fine granular structure; friable, slightly sticky and slightly plastic; many fine to medium roots; granitic rock outcrops occupy about 30 percent of the area; about 15 percent quartz grit and some larger gravel and stones; gradual wavy boundary; pH 7.0.

A12 -- 12 to 38 cm. Dark brown (10YR 3/3) loam; moderate fine to medium granular structure; friable, slightly sticky and slightly plastic; common fine to medium roots; quartz as in layer above; clear wavy boundary; pH 6.5.

B -- 38 to 45 cm. Yellowish brown (10YR 5/8) stony sandy loam; structureless (massive) breaking in hand to weak medium granular; friable, slightly sticky and nonplastic; few fine yellow mica flakes; about 20 percent slightly weathered granitic rock, stones and gravel; few fine living roots; abrupt wavy boundary; pH 6.0.

R -- 45 cm. Unweathered hard granitic bedrock.

Type Location: Pyeongchang Gun, Gangweon Do, about 200 m. west of Sangdong Ri, Bangrim Myeon.

Range in Characteristics: Thickness of the soil over hard rock ranges from about 20 to 50 cm. Thickness of the dark colored A horizon ranges from about 25 to 40 cm. and averages about 30 cm. Bedrock outcrops range from few to 90 percent and are commonly associated with stoniness. Less than 35 percent stone, angular cobbly and gravel are on the surface and throughout the profiles. Base saturation is less than 50 percent and the reaction is strongly to medium acid. A horizons are dark brown, very dark brown, very dark grayish brown or black more or less gravelly loam, fine sandy loam or sandy loam. C horizons are thin yellowish brown, strong brown, dark yellowish brown, pale brown or brown gravelly sandy loam, loam or loamy sand, with less than 35 percent loose coarse fragments of weathered granite or granite gneiss.

Competing Series and Their Differentiae: These are the Mudeung, Weoljeong, Samgag, Gwanag, Taehwa, Daegu, Habin, and Jangseong series. The Mudeung soils have somewhat thinner less organic A horizons, fine loamy textures, are free of mica and are derived from andesite porphyry parent materials. The Weoljeong soils have similar textures and very deep strongly weathered saprolite. The Samgag soils lack dark colored surfaces, have coarse loamy textures and very deep saprolite. The Gwanag soils lack umbric epipedons, have coarse loamy textures and thin saprolite. The Taehwa soils have lighter colored A horizons, cambic B horizons with fine loamy textures, are free of mica and are deep over hard bedrock. The Daegu and Habin soils have finer textures, higher base saturation, and are derived from shale and sandstone materials. The Jangseong soils have finer textures, less brown collors, high base saturation, near neutral reaction and are derived from limestone materials.

Setting: The Odae soils occur in steep mountainous areas at high elevations with cool moist climate and granitic geology. The slopes range from 20 to 90 percent or more and the dominant slopes are in excess of 65 percent.

Principal Associated Soils: The Odae soils are associated chiefly with the Chahang, Weoljeong and to less extent the Gwanag soils on similar physiography. The Imog soils are more deep, contain less coarse fragments, few or no rock outcrops, and occur in local valley alluvial accumulations. The Chahang soils are similar except for having thick fine loamy cambic B horizons and very deep saprolite.

Drainage and Permeability: Somewhat excessively drained. Permeability is moderately rapid or rapid and surface runoff is moderate or slow because of the high infiltration rate. Lateral movement of rainwater below the surface is probably moderately rapid.

Use and Vegetation: Most of these soils are used for pine forest; however some areas contain mixed coniferous and deciduous forest generally with deciduous undergrowth. Vegetable and grain crops are cultivated in a few small areas.

Distribution and Extent: These soils are of moderate extent and occur at high elevations with cool moist climate mainly in the northeastern part of the country.

Series Established: Pyeongchang Gun, Gangweon Do, 1968.

Remarks: No explanation is available for the high content of calcium shown in the analyses of this and some related soil series.

Odae Series Contd.

Lab. Nos. Mh94-96 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0-12	A11	6.9	11.0	8.8	6.7	5.9	6.3	41.6	19.7	L	27.4	24.7	28.2	CL
12-38	A12	11.8	10.2	9.5	8.5	8.1	8.3	39.3	16.1	L	29.5	27.2	27.2	CL
38-45	C	34.6	9.7	12.7	11.6	10.7	10.4	33.5	11.4	SL	35.7	32.1	20.8	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	pH 1 N KCl	O.M. %	2/ CEC (me/100g)	Extractable Cations Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
	36.9	18.3	5.9	4.7	7.60	18.80	8.50	2.12	0.05	0.50	0.22	59.4	98.1
	33.1	9.7	5.3	4.2	2.50	6.90	0.08	0.10	0.10	0.05	2.38	4.8	12.2
	24.6	6.7	5.3	4.1	0.58	4.85	0.05	0.08	0.05	0.02	1.94	4.1	9.3

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
HSY, KPJ, UKT, JFD
3 July, 1969

OESAN SERIES

The Oesan series is a member of the loamy skeletal, mixed, mesic family of Typic Dystrochrepts (Lithosols). These soils have thin brown to dark brown channery loam A horizons and thick dark yellowish brown very channery silt loam cambic B horizons. The C horizons are yellowish brown very channery silt loam. Depth to bedrock is about 70 cm. They have developed in residuum from micaceous schist and gneiss in hilly and mountainous areas.

Typifying Pedon: Oesan channery loam, eroded - corn (Field description Pyeongchang Gun profile No. 7; colors are for moist soil.)

Ap -- 0 to 13 cm. Brown to dark brown (10YR 4/3) channery loam; moderate very fine and fine granular structure; friable, slightly sticky and slightly plastic; common fine yellowish mica; many fine to medium corn roots; approximately 20 to 30 percent slightly weathered angular schist fragments and few stones; abrupt smooth boundary; pH 5.5.

B1 -- 13 to 18 cm. Dark yellowish brown (10YR 3/4) very channery silt loam; weak fine subangular blocky structure breaking to moderate fine granular; sticky and slightly plastic; mica as above; common fine to medium corn roots; approximately 40 percent schist fragments and few stones as above; diffuse wavy boundary; pH 5.5.

B2 -- 18 to 50 cm. Yellowish brown (10YR 5/4) very channery silt loam; weak medium subangular blocky and moderate granular structure; friable, slightly sticky and slightly plastic; mica as above; approximately 50 percent schist fragments and some stones as above; no roots; pH 5.5.

R -- 50 cm. Very pale brown and yellowish brown hard mica schist or phyllite bedrock.

Type Location: Pyeongchang Gun, Gangweon Do, on a hill about 100 meters west of Sangan Ri, Daehwa Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. over hard bedrock. 35 to 90 percent weathered angular mica schist, phyllite and quartz fragments and some stones are throughout the profiles and generally increase with depth. A horizons contain about 10 to 25 percent coarse fragments on the average. Reaction is strongly to slightly acid. Base saturation is mostly less than 60 percent. Common fine mica occurs throughout the profile. A horizons are brown to dark brown channery loam or silt loam. Dark yellowish brown surface horizons may occur in eroded areas. Cambic B horizons are mainly yellowish brown, dark yellowish brown or strong brown very channery silt loam or loam. C horizons are thin or very thin dark yellowish brown, yellowish brown, brown or pale brown very channery silt loam, loam or heavy sandy loam grading to hard bedrock.

Competing Series and Their Differentiae: These are chiefly the Weoljeong, Samgag, Gwanag, Odae, Mudeung and Nagseo soils. The Weoljeong soils have dark A horizons, coarse loamy textures and granitic saprolite. The Samgag soils have coarse loamy textures and deeply weathered granitic saprolite. The Gwanag soils are shallow over hard granitic bedrock. The Odae soils are shallow over hard granite bedrock and have dark colored A horizons. The Mudeung soils are shallow over hard porphyry bedrock, have fine loamy textures and are free of mica. The Nagseo soils have red colors.

Setting: The Oesan soils occur chiefly in moderately steep to very steep hilly and mountainous regions in areas underlain by mica schist, mica gneiss, phyllite and similar materials. Slopes ranges from 10 to 100 percent and more with dominant slopes ranging from 30 to 60 percent.

Principal Associated Soils: These soils are associated with the Gwanag, Odae, Chahang, Pyeongchang, Weoljeong and Samgag soils all in similar upland positions. The Chahang soils have deeply weathered saprolite and dark colored A horizons. The Pyeongchang soils are deep, very fine clayey and are derived from limestone materials.

Drainage and Permeability: Well drained. Permeability is moderate or rapid. Runoff may be rapid or very rapid depending on the slope.

Use and Vegetation: Most of these soils are used for coniferous or mixed coniferous and deciduous forest. Some small areas especially near natural drainage ways are cultivated to corn, potato, barley, tobacco, red pepper and similar crops.

Distribution and Extent: This series is of moderate extent and occurs throughout the country in hilly and mountainous areas.

Series Established: Pyeongchang Gun, Nov. 1968.

Remarks: Base saturation in the analytical data of the typifying pedon is somewhat higher than typical for the series.

Oesan Series Contd.

Lab. Nos. Mh25-27 **Typifying Pedon**

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0-13	Ap	28.2	8.4	7.2	7.8	7.3	6.5	48.0	14.8	L	24.7	25.6	34.9	L
13-18	B1	24.5	5.6	7.0	7.9	7.1	6.7	50.1	15.6	SiL	21.8	23.7	38.9	CL
18-50	B2	30.7	5.6	6.3	7.8	7.6	6.8	53.8	13.1	SiL	21.1	26.4	39.4	L

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
39.8	32.8	11.0	6.0	4.7	2.47	13.85	8.00	0.90	0.08	0.12	0.05	65.7	99.5
41.4	32.5	10.8	6.1	4.5	2.88	13.10	8.37	0.65	0.05	0.10	0.05	70.0	99.5
32.7	28.5	7.7	6.1	4.5	0.98	7.75	3.89	0.30	0.05	0.05	0.32	55.4	93.1

1/ Pipette Method, Sodium Hexametn-phosphate

2/ Ammonium Acetate Method

Established Series
KBJ, HSY, UKT, JFD
22 November, 1969

PYEONGAN SERIES

The Pyeongan series is a member of the fine clayey, mesic family of Typic Hapludalfs (Red-Yellow Podzolic soils with high base status). These soils have thin brown to dark brown cobbly clay loam surface horizons and deep yellowish red cobbly clay Bt horizons. They are developed in very deep moderately dissected cobbly mountain colluvium and fan terraces derived mainly from limestone and similar materials.

Typifying Pedon: Pyeongan cobbly clay loam - corn (Field description Pyeongchang Gun profile No. 103; colors are for moist soil.)

Ap --- 0 to 17 cm. Brown to dark brown (7.5YR 4/4) cobbly clay loam; moderate fine to medium granular structure; friable, sticky and plastic; many fine pores; few worm casts; about 15 percent slightly weathered angular limestone gravel and cobbles; abundant fine and medium roots; abrupt smooth boundary; pH 7.5.

B1 --- 17 to 40 cm. Reddish brown (5YR 4/4) gravelly light clay loam; moderate fine to medium subangular blocky structure; friable, sticky and plastic; common fine continuous vertical inped tubular simple pores; few worm casts; abundant fine to medium roots; coarse fragments slightly smaller than above; gradual wavy boundary; pH 7.5.

B21t --- 40 to 70 cm. Yellowish red (5YR 4/6) cobbly clay; moderate fine to medium subangular blocky structure; firm, very sticky and very plastic; patchy thin clayey cutans; common fine continuous vertical inped tubular simple pores; abundant fine roots; about 20 percent slightly weathered angular limestone cobbles and few pieces of gravel; clear wavy boundary; pH 6.5.

B22t --- 70 to 110 cm. Yellowish red (5YR 4/6) gravelly to cobbly clay; moderate medium to coarse subangular blocky structure; firm, very sticky and very plastic; patchy moderately thick clayey cutans; few fine discontinuous vertical and oblique inped tubular simple pores; few fine roots; gravel and cobbles as above and increasing with depth; pH 7.5.

Type Location: Pyeongchang Gun, Gangweon Do, about 150 meters north of Bamchi Ri, Mitan Myeon.

Range in Characteristics: Solum thickness ranges from about 100 to 150 cm. or more. Depth to bedrock is generally greater than 2 m. ranging from 1.5 to several meters. Reaction is slightly acid to neutral showing little variation with depth. Base saturation is more than 60 percent in the solum. These soils have about 10 to 35 percent slightly or moderately weathered angular gravel and cobbles throughout the profiles except where removed from the surface layer by farmers. A or Ap horizons are 10 to 20 cm. thick, brown to dark brown or where eroded strong brown or sometimes yellowish red clay loam or silty clay loam with varying amounts of gravel and cobbles. Where severely eroded Ap horizons may be gravelly or cobbly clay. Bt horizons are commonly yellowish red, reddish brown or red mainly clay loam to clay with 7 to 35 percent slightly to moderately weathered angular limestone cobbles and or gravel. Clay content of the Bt horizons ranges from 35 to 60 percent. C horizons are dominantly yellowish brown, strong brown or pale brown more or less homogeneous sometimes slightly stratified cobbly clay loam, fine sandy loam or silt loam cobbly and stony colluvium, becoming coarser with depth.

Competing Series and Their Differentiae: These are the Pyeongchang, Gaghwa, Ungyo, Iweon, Mitan and Ungyo soils. The Pyeongchang soils are more strongly developed, contain more clay (more than 60 percent) and contain few or no gravel and cobbles. The Gaghwa soils are similar to the Pyeongan soils except for having low base saturation (less than 35 percent), more acid reaction and more acidic parent materials. The Ungyo soils are similar except for being more acid, having low base saturation, acidic parent materials and darker colored surfaces. The Iweon soils have coarse loamy textures, low base saturation and are derived from acidic crystalline materials. The Mitan soils have clayey skeletal textures and cambic B horizons.

Setting: The Pyeongan soils are formed in very deep moderately dissected unconsolidated mountain colluvial and fan terrace deposits derived from limestone materials. Dominant slopes are 15 to 30 percent and the range is between 7 and 60 percent.

Principal Associated Soils: The Pyeongchang, Jangseong and Mitan soils are usually associated at higher elevations. The Maji soils commonly occur on local alluvial fans at lower elevations.

Drainage and Permeability: Well drained and very slowly permeable. Runoff is medium to rapid depending on the slope gradient.

Use and Vegetations: Most areas are planted to potato , corn, radish, Indian millet and similar crops. Some areas grow pine forest.

Distribution and Extent: The Pyeongan soils are of small extent, but are locally important for agricultural use. They occur mainly in the central northeastern part of the country in the limestone areas.

Series Established: Pyeongchang Gun, November 1968.

Remarks: The Pyeongan series derived from limestone materials is the equivalent of the Gaghwa series derived from granitic materials. Note that the coarse fragments (cobble and most gravel) were excluded from the sample analyzed. No explanation is available for the lower clay and higher silt content in the B1 horizon analysis except for the possibility of stratification of parent materials.

Lab. Nos. Mh237-240 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 17	Ap	5.7	1.1	1.7	4.7	7.0	6.0	42.4	37.1	CL	8.7	22.8	31.4	LiC
17- 40	B1	4.8	——	4.6	——	6.6	5.4	58.0	26.6	SiL	4.6	23.0	45.8	SiC
40- 70	B21t	3.4	——	3.0	——	5.9	5.0	34.8	51.3	C	3.5	18.0	27.2	HC
70-110	B22t	2.7	——	2.0	——	4.9	4.0	31.3	57.8	C	2.8	17.5	21.9	HC

pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
				me/100g							
6.9	5.3	1.56	11	15.10	12.25	1.62	0.10	0.25	-	94.2	-
6.8	5.0	0.65	2	13.60	9.75	1.37	0.08	0.17	-	83.6	-
6.2	4.9	0.54	2	19.00	14.00	1.50	0.10	0.25	-	83.4	-
6.5	5.5	0.57	14	23.85	21.00	1.25	0.10	0.30	-	95.0	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
HSY, KBJ, UKT, JFD
21 November, 1969

PYEONGCHANG SERIES

The Pyeongchang series is a member of the very fine clayey, mixed, mesic family of Typic Hapludalfs (Red-Yellow Podzolic soils with high base status). These soils have thin brown to dark brown clay loam A horizons and deep red clay Bt horizons. The C horizons are yellowish red to pale brown very fine sandy loam derived from residual limestone materials.

Typifying Pedon: Pyeongchang clay loam, eroded - soybean (Field description Pyeongchang Gun profile No. 1; colors are for moist soil except as noted.)

Ap -- 0 to 10 cm. Yellowish brown (10YR 5/4) dry, brown to dark brown (7.5YR 4/4) clay loam; moderate fine and medium granular structure; friable, sticky and plastic; common very fine and fine dendritic tubular pores; common fine to medium soybean roots; abrupt smooth boundary; pH 6.0.

B1t -- 10 to 30 cm. Yellowish red (5YR 4/8) clay; moderate fine to medium subangular blocky structure; firm, very sticky and very plastic; few fine to medium soybean roots; common worm holes; gradual wavy boundary; pH 6.3.

B21t -- 30 to 60 cm. Red (2.5YR 4/6) clay; strong medium angular blocky structure; firm, very sticky and very plastic; thin continuous clay cutans; few fine soybean roots; clear wavy boundary; pH 6.5.

B22t -- 60 to 80 cm. Red (2.5YR 4/6) clay; many medium soft black (10YR 2/1) Mn concretions; strong coarse and medium angular blocky structure; very firm, very sticky and very plastic; moderately thick continuous clay cutans; clear wavy boundary; pH 7.7.

B31t -- 80 to 120 cm. Red (2.5YR 4/6) clay; few Mn concretions as above; strong medium angular blocky structure; common strongly weathered yellowish brown limestone rock materials; firm, very sticky and very plastic; cutans as above; clear wavy boundary; pH 7.7.

B32t -- 120 to 150 cm. Yellowish red (5YR 4/6) clay; moderate coarse angular blocky structure; firm, very sticky and very plastic; common fine to medium weathered gravel as above; gradual wavy boundary; pH 8.0.

C -- 150 to 200 cm. Pale brown (10YR 6/3) and yellow (10YR 8/6) very fine sandy loam; structureless (massive); firm, slightly sticky and slightly plastic; pH 8.5.

Type Location: Pyeongchang Gun, Gangweon Do, 300 meters north of Pyeongchang Myeon Office on hill east of the road.

Range in Characteristics: Solum thickness ranges from 1 to 1.5 meters and depth to hard rock is generally greater than 2 meters though limestone bedrock outcrops may occur. Reaction is slightly acid to neutral in the solum increasing somewhat with depth to alkaline in the C horizon. Base saturation in the solum averages high though the upper B horizons may be medium. The Ap or A1 horizons are 5 to 20 cm. thick, brown to dark brown or reddish brown moist and yellowish brown, strong brown or brown when dry, clay loam to clay with moderate or strong granular structure. Bt horizons are yellowish red or red clay with strong blocky structure. C horizons are yellowish red, pale brown or yellowish brown very fine sandy loam, silt loam or loam. Thickness of the saprolite is variable ranging from 50 cm. to more than 2 meters and averaging about one meter. The boundary of saprolite with bedrock is abrupt. The Pyeongchang soils are mica free and some coarse fragments generally occur throughout the profiles.

Competing Series and Their Differentiae: These are the Sirye, Pyeongan, Gwangsan, Bancheon and Changpyeong soils. The Sirye soils have fine clayey textures, moderate depth, strongly to medium acid reaction and are formed from grayish brown shale parent materials. The Pyeongan soils have less distinct structure and are formed in mountain colluvial and fan terrace cobbly fine earth accumulations. The Gwangsan soils have deeply weathered granitic parent materials, mica and low base saturation. The Bancheon and Changpyeong soils have fine clayey textures, medium to slightly acid reaction, mica and are developed in deep stratified old alluvial materials on dissected river terraces.

Setting: The Pyeongchang soils occur mainly on moderately steep to very steep hills and mountains underlain by residual limestone materials. Dominant slopes are about 40 percent and the range is from 15 to 60 percent.

Principal Associated Soils: These are mainly the Pyeongan, Maji, Jangseong and Chahang soils. The Pyeongan soils are associated in dissected mountain colluvium. The Maji soils are associated in local alluvial positions while the Jangseong soils are associated in steeper and more convex residual upland positions. The Chahang soils occur in associated granitic areas.

Drainage and Permeability: Well drained and very slowly permeable. Runoff is medium to very rapid depending on the slope. Owing possibly to strong structural aggregation, these soils are more stable and less erodible than similar soils in granitic areas.

Use and Vegetation: Corn, soybean, buckwheat, barley, potato, cabbage and red pepper are common crops. A few areas on very steep slopes grow wild grass and pine forest vegetation.

Distribution and Extent: These soils are of relatively small extent nation wide but are locally important to agriculture. They occur in the central northeastern part of the country in the limestone areas.

Series Established: Pyeongchang Gun, Gangweon Do, October 1967.

Remarks: Only very limited analytical data is available to date. Both shallow and moderately deep reddish brown clay soils with other characteristics similar to the Pyeongchang series have been observed but have not been correlated in the Detailed Soil Surveys to date, thus no series descriptions have been prepared for those soils.

Lab. Nos. Mh1-7 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay ≤.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	Ap	12.2	2.2	3.0	5.1	6.4	5.1	46.2	31.7	CL	11.3	24.7	32.3	LiC
10- 30	B1t	6.2	0.8	1.5	1.8	2.2	1.8	25.6	66.3	C	4.5	6.3	22.9	HC
30- 60	B21t	1.9	1.1	1.4	1.8	2.1	1.7	17.9	74.0	C	4.6	7.0	14.4	HC
60- 80	B22t	1.8	0.6	1.2	1.5	1.7	1.3	20.9	72.8	C	3.6	12.1	11.5	HC
80-120	B31t	1.7	0.7	0.9	1.4	1.6	1.2	11.6	82.6	C	3.3	4.2	9.9	HC
120-150	B32t	1.1	1.1	1.7	2.2	2.7	2.9	13.4	76.0	C	5.4	9.1	9.5	HC
150-200	C	18.0	0.3	0.7	1.6	16.1	54.2	14.3	12.8	VFSL	3.0	81.2	3.0	LFS

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
38.9	30.4	16.3	6.3	5.2	3.55	29	17.50	11.30	4.00	0.82	0.50	0.05	94.9	99.7
49.0	36.9	24.2	5.1	3.7	1.10	4	29.00	4.17	4.52	0.32	0.26	10.09	31.9	47.9
51.0	38.8	26.9	5.2	3.6	0.52	0	30.30	8.82	7.10	0.26	0.32	8.42	54.4	66.2
55.0	41.8	28.3	6.3	4.9	0.49	0	38.00	15.70	11.45	0.32	0.38	0.11	71.2	99.6
57.6	45.1	29.0	6.8	5.7	0.42	0	37.00	15.25	10.80	1.86	0.40	0.05	76.6	99.8
55.9	42.2	28.2	7.5	6.1	0.45	0	35.50	17.35	11.80	0.32	0.46	0.05	84.3	99.8
-	8.6	4.5	8.1	7.0	0.10	0	9.00	4.28	0.10	0.26	0.10	0.05	69.0	99.2

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
21 November, 1969

SACHON SERIES

The Sachon series is a member of the coarse loamy, mixed, nonacid, mesic family of Aeric Fluventic Haplaquepts (Alluvial soils). These soils have moderately thick very dark grayish brown sandy loam Apg horizons in paddy and moderately deep yellowish brown sandy loam cambic B horizons with common dark grayish brown mottles. The Cg horizons are dark grayish brown loam or sandy loam with common to many yellowish brown or strong brown mottles. They are developed in gently sloping narrow local valley alluvium on local alluvial plains, fans and foot slopes mostly in granitic areas.

Typifying Pedon: Sachon loam - rice paddy (Field description Ulju Gun profile No. 73; colors are for moist soil.)

Ap1g -- 0 to 6 cm. Very dark grayish brown (10YR 3/2) loam; few fine faint strong brown (7.5YR 5/6) mottles; puddled structure; dries and breaks to weak medium granular; friable, slightly sticky and slightly plastic; many very fine and medium dead rice roots; abrupt smooth boundary; pH 5.5.

Ap2g -- 6 to 15 cm. Dark grayish brown to very dark grayish brown (10YR 3.5/2) loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky and coarse platy structure; firm, slightly sticky and slightly plastic; common fine and medium continuous vertical inped simple tubular pores; common fine and medium roots; clear wavy boundary; pH 6.2.

A3g -- 15 to 30 cm. Dark gray (10YR 4/1) loam; many fine prominent yellowish red (5YR 4/6) mottles; crushed color brown to dark brown (10YR 3/4); weak coarse prismatic structure breaking to weak medium subangular blocky; firm, sticky and plastic; thin patchy dark grayish brown exprism cutans; many fine and medium continuous vertical inped simple tubular pores; few fine and medium roots; clear wavy boundary; pH 6.3.

B -- 30 to 66 cm. Dominantly strong brown (7.5YR 5/8) loam; common moderately thick continuous dark grayish brown (10YR 4/2) exprism cutans and mottles; crushed color yellowish brown (10YR 5/4); weak coarse prismatic structure; firm, slightly sticky and slightly plastic; many fine and medium continuous vertical inped and exped simple tubular pores; gradual wavy boundary; pH 6.5.

Cg -- 66 to 130 cm. Dark grayish brown (10YR 4/2) loam; common medium distinct strong brown (7.5YR 5/8) mottles; crushed color yellowish brown (10YR 5/4); weak coarse prismatic structure becoming structureless (massive) and weakly stratified below 80 cm.; firm, slightly sticky and slightly plastic; many fine and medium continuous vertical inped simple tubular pores.

Type Location: Ulju Gun, Gyeongsangnam Do, about 100 meters west of Hyangsan Primary School, Hyangsan Ri, Sanbug Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is greater than 3 meters. Base saturation is more than 60 percent in the control section. Reaction is strongly to medium acid in surface, medium to slightly acid in the B and slightly acid to neutral in the C horizons. There are few to common mica flakes throughout. Ap horizons are 20 to 30 cm. thick, very dark grayish brown, dark grayish brown, grayish brown or gray loam, sandy loam or silt loam with distinct or prominent mottles. The cambic B horizons are yellowish brown, dark yellowish brown or strong brown sandy loam, loam or silt loam with weak coarse prismatic structure and thin continuous or discontinuous gray, grayish brown, dark grayish brown or olive gray exprism cutans. C horizons are usually grayish brown weakly stratified sandy loam and loam with strong brown mottles.

Competing Series and Their Differentiae: These include the Hagsan, Tongcheon, Yongji, Seoggye, Jisan, Sangju, Togye and Ibseog series. The Hagsan soils have coarse loamy textures and sandy substrata. The Tongcheon soils have gravelly coarse loamy B horizons, and very gravelly coarse loamy C horizons. The Yongji and Jisan soils have fine loamy textures. The Seoggye soils have coarse loamy textures throughout, and occur on broad alluvial plains.

Setting: The Sachon series occurs in gently sloping to sloping narrow local valley alluvium derived from coarse loamy granitic soil materials. Dominant slopes are 2 to 15 percent and the range is from 2 to 35 percent.

Principal Associated Soils: These include the Samgag, Togye, Ibseog, Sangju, Seongsan, Jisan, Tongcheon and Seoggye series. The Samgag, Togye, Ibseog and Sangju soils occur above and adjacent to the Sachon soils in footslope positions. The Samgag soils are in residual upland positions. The Sangju soils lack gray mottles, are better drained and have yellower colors. The sandy Togye and Ibseog soils lack gray mottles and are better drained. The Jisan, Tongcheon and Seoggye soils are associated in similar physiographic positions. The Seongsan soils lack gray mottles, are better drained and have redder colors.

Drainage and Permeability: The Sachon soils have imperfect drainage, moderately rapid permeability and slow runoff as essentially all areas are level terraced for paddy rice land use.

Use and Vegetation: The Sachon soils are used for flood irrigated paddy rice and nonirrigated barley.

Distribution and Extent: The Sachon series is of small extent and is distributed in narrow local valleys throughout the granitic areas of the country.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966.

Sachon Series Contd.

Lab. Nos. U416-420 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
0- 6	Ap1g	1.8	——3.0——		9.7	13.5	6.3	42.3	25.2	L	16.2	30.5	28.1	LiC
6- 15	Ap2g	0.9	——3.2——		8.9	12.1	7.0	45.2	23.6	L	15.4	28.5	32.5	CL
15- 30	A3g	1.3	——3.6——		11.0	14.3	8.6	41.2	21.2	L	18.4	34.8	25.6	CL
30- 66	B	1.4	——5.8——		16.3	19.3	9.2	32.7	16.7	L	27.1	34.9	21.3	CL
66-130	Cg	0.9	——4.8——		16.1	19.8	10.9	33.8	14.6	L	26.1	41.0	18.3	FSL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	S.G.	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	Free Fe_2O_3 %	CEC 2/	Extractable Cations Ca	Mg	Na	K	H
										me/100g				
	40.4	13.8	2.56	4.9	3.9	3.80	147	0.88	12.0	3.85	1.05	1.00	0.33	-
	36.5	14.3	2.56	5.0	3.9	3.20	122	0.88	11.8	4.25	0.80	0.10	0.20	-
	30.4	13.0	2.61	5.5	4.4	2.60	44	1.20	9.6	4.75	1.25	0.10	0.18	-
	22.6	9.2	2.67	6.2	4.9	0.80	-	1.37	7.0	4.75	0.70	0.65	0.20	-
	20.2	7.8	2.66	6.8	5.2	0.60	-	1.17	7.1	5.65	1.20	0.75	0.22	-

Base Saturation % CEC	Sum of Cations
51.9	-
45.3	-
65.4	-
87.1	-
110.1	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
19 November, 1969

SADU SERIES

The Sadu series is a moderately deep member of the sandy over loamy, mixed, mesic family of Aquic Udipsamments (Alluvial soils). These soils have moderately thick dark grayish brown fine sandy loam Apg horizons and moderately deep pale yellow fine sand C1 horizons overlying stratified dark grayish brown silty clay loam, sand or fine sandy loam Cg horizons. They are developed on broad alluvial plains derived from continental materials.

Typifying Pedon: Sadu fine sandy loam; rice paddy (Field description Gimhae Gun profile No. 12; colors are for moist soil.)

Ap1g -- 0 to 10 cm. Dark grayish brown (10YR 4/2) fine sandy loam; few medium prominent yellowish red (5YR 4/6) mottles; puddled structure; dries and breaks to weak coarse granular; friable, slightly sticky and nonplastic; many fine white and yellow mica flakes; many fine rice roots; clear smooth boundary; pH 5.7.

Ap2g -- 10 to 20 cm. As above except common rice roots; abrupt smooth boundary; pH 6.0.

C1 -- 20 to 60 cm. Pale yellow (2.5Y 7/4) fine sand; common medium prominent strong brown to brown (7.5YR 5/5) and few fine prominent reddish brown (5YR 4/4) mottles; few fine prominent reddish brown (5YR 4/4) mottles; few fine prominent dark reddish brown (5YR 3/2) Mn concretions; crushed color brown (10YR 5/3); structureless, (single grain); loose, nonsticky and nonplastic; clear smooth boundary; pH 6.0.

C2ir -- 60 to 72 cm. Brownish yellow (10YR 6/6) fine sand; many coarse prominent yellowish red (5YR 5/8) mottles; crushed color strong brown (7.5YR 5/8); structureless, (single grain); loose, nonsticky and nonplastic; many fine white and yellow mica flakes; abrupt wavy boundary; pH 5.8.

C3g -- 72 to 100 cm. Dark gray to dark grayish brown (10YR 4/1.5) silty clay loam; common fine, medium and coarse prominent dark reddish brown (5YR 3/2) and common medium to coarse distinct yellow to brownish yellow (10YR 6.5/6) mottles along remnants and channels of medium to coarse semidecomposed reed stems and roots; structureless (massive); clear smooth boundary; pH 6.5.

C4g -- 100 to 120 cm. Gray to dark gray (5Y 4.5/1) fine sandy loam; few coarse distinct yellow to olive yellow (2.5Y 6.5/6) mottles; reed stems and roots as above; pH 6.7.

Type Location: Gimhae Gun, Gyeongsangnam Do, 100 meters east of Gimhae ROKAF Airport, Sadu Ri, Daejeo Myeon.

Range in Characteristics: The Sadu soils have sandy textures between 50 and 100 cm. thick over strongly contrasting strata. Soil depth over hard rock is probably 5 meters or more. Reaction is slightly to medium acid. Base saturation is more than 60 percent. White and yellow mica commonly occurs throughout the profiles. Semidecomposed reed stems and roots may or may not occur in the upper C horizons. Apg horizons are dark gray, dark grayish brown or gray fine sandy loam, loamy fine sand or loam with few yellowish red or strong brown mottles. Apg gley is due to paddy rice irrigation. The upper C horizons are pale yellow, brownish yellow or yellowish brown fine sand or loamy fine sand with strong brown, brown or yellowish red mottles. The lower Cg horizons below 50 cm. are stratified dark gray, gray, grayish brown or dark grayish brown silty clay loam, sand and or fine sandy loam with yellow, olive yellow or brownish yellow mottles.

Competing Series and Their Differentiae: These are the Nagdong, Hwabong, Hwangryong, Tongcheon, Sachon and Myeongji soils. The Nagdong soils lack gray mottles above 100 cm. and are well drained. The Hwabong soils lack gray mottles and have deep coarser sandy textures. The Hwangryong series have sandy skeletal textures and deep water tables. The Tongcheon soils have loamy skeletal textures. The Sachon soils have coarse loamy textures, higher water tables and imperfect drainage. The Myeongji soils have deep sandy textures and thick dark colored A horizons.

Setting: The Sadu soils occur on broad flat fluvio-marine and continental alluvial plains in levee positions and are formed in stratified continental alluvial materials. Dominant slopes are about 1.0 percent and the range is from 1.0 to 2.0 percent.

Principal Associated Soils: These soils are commonly associated with the Deunggu, Myeongji, Haecheog and Nagdong soils on fluvio-marine plains. The Deunggu and Haecheog soils have fine silty textures and yellow iron sulfide mottles in the Bg horizons. The Myeongji soils occur near the sea on river deltas. The Nagdong soils have very deep ground water tables.

Drainage and Permeability: Moderately well drained. Runoff is artificially controlled as most areas are leveled for paddy rice production. Permeability is probably moderate or moderately rapid above the water table.

Use and Vegetation: Most areas of these soils are used for paddy rice. Small areas are used for onion, Chinese cabbage, cabbage, melon, water melon and similar vegetable crops.

Distribution and Extent: The Sadu series is of small extent and is known to occur only on the Nagdong River delta.

Series Established: Gimhae Gun, Gyeongsangnam Do, 1968.

Lab. Nos. G167-71 Typifying Pedon

			Particle Size Distribution 1/ (mm) %												
			U. S. Department of Agriculture								International				
Depth cm	Hori-zon	Gra-vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 10	Ap1g	0.0	20.2			45.6	5.3	21.5	7.4	FSL	30.7	46.7	15.2	FSL
10- 20	Ap2g	0.0	0.6		17.1	44.6	6.2	23.1	8.4	FSL	26.2	49.9	15.5	FSL
20- 60	C1	0.0	0.4		25.3	67.9	2.6	2.5	1.3	FS	41.1	57.2	0.4	FS
60- 72	C2ir	0.0	0.7		24.5	67.7	4.0	3.1	0.0	FS	38.3	60.6	1.1	FS
72-100	C3g	0.0	3.1			9.8	3.5	54.2	29.4	SiCL	4.7	24.7	14.2	LiC

Moisture Retention %			Bulk Density g/cc	pH		O.M.	Avail. P_2O_5 ppm	Mn ppm	Free Fe_2O_3 %	2/ CEC	Extractable Cations				
1/10 atms	1/3 atms	15 atms		H_2O (1:1)	1 N KCl	%					Ca	Mg	Na	K	H
										me/100g					
30.5	18.8	8.3	1.28	4.5	3.6	1.05	275	4.4	0.66	4.20	1.90	0.85	0.40	0.10	1.00
31.5	19.2	7.9	1.28	4.6	3.6	0.95	205	-	0.64	4.00	1.80	0.90	0.40	0.23	1.00
16.3	4.5	3.2	1.30	5.4	4.0	0.10	22	1.9	0.43	2.10	1.05	0.60	0.15	0.08	0.19
20.4	4.6	3.4	-	6.6	5.1	0.06	12	-	0.33	2.20	1.35	1.10	0.23	0.10	0.05
-	-	-	-	4.6	3.6	1.33	3	-	1.49	9.10	3.15	3.50	0.73	0.50	0.24

Base Saturation %		Elemental Analysis of Clay						3/
CEC	Sum of Cations	Igni. loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	CEC me/100g
77.4	76.5	9.47	2.31	47.64	8.83	29.39	1.94	37.0
83.3	76.9	-	-	-	-	-	-	-
89.5	90.8	9.18	2.31	47.56	9.36	28.97	1.49	-
126.4	98.2	-	-	-	-	-	-	-
86.6	97.0	-	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, NaCl Extracted

Established Series
UKT, JFD
21 November, 1969

SAMAM SERIES

The Samam series is a member of the fine loamy, mixed, mesic family of Aquic Dystric Eutrochrepts (Alluvial soils). These soils have moderately thick dark reddish gray loam Apg horizons in paddy, dark reddish brown loam A horizons in upland crops, and moderately deep reddish brown or weak red loam cambic B horizons. C horizons are weak red weakly stratified silt loam with gray mottles. The Samam soils occur in local valley alluvium derived from red shale soil materials.

Typifying Pedon: Samam loam - paddy rice (Field description Puyeo Gun profile No. 196; colors are for moist soil.)

Ap1g -- 0 to 16 cm. Dark reddish gray (5Y 4/2) loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; abrupt smooth boundary; pH 5.5.

Ap2 -- 16 to 40 cm. Reddish brown (5YR 4/3) loam; few medium faint brown to dark brown (7.5YR 4/4) mottles; weak coarse prismatic structure breaking to weak coarse platy and blocky; friable, slightly sticky and slightly plastic; thin discontinuous weak red (2.5YR 4/2) exprism clayey cutans; gradual smooth boundary; pH 5.0.

B2 -- 40 to 65 cm. Reddish brown (5YR 4/3) loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure breaking to weak coarse subangular blocky; friable, sticky and plastic; thin discontinuous exprism clayey cutans; gradual smooth boundary; pH 7.0.

B3 -- 65 to 100 cm. Reddish brown (5YR 4/3) silt loam; few medium yellowish brown to brown (10YR 5/3.5) inprism mottles; weak coarse prismatic structure; friable, slightly sticky and slightly plastic; few fine medium worm holes; few fine mica flakes; few fine Mn concretions; clear smooth boundary; pH 7.0.

C -- 100 to 105 cm. Weak red (2.5YR 4/2) silt loam; common fine faint dark gray (2.5Y 4/1) mottles; structureless (massive); firm, sticky and plastic; few fine gravel; pH 7.0.

Type Location: Buyeo Gun, Chungcheongnam Do, 1 km. north of Cheongpo Ri, Sedo Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock ranges chiefly from 1 to 3 meters. Base saturation is more than 60 percent. Reaction is strongly acid in the surface and slightly acid to neutral in the B and C horizons. The solum contains few mica flakes and less than 10 percent coarse fragments. Where cultivated for upland crops the Ap horizons are moderately thick dark reddish brown, reddish brown, weak red or dark brown and where cultivated for paddy rice the Apg horizons are dark reddish gray or reddish gray mottled loam or silt loam. Cambic B horizons are reddish brown, weak red, dark reddish brown, dusky red or light reddish brown loam, silt loam, light clay loam or light silty clay loam with few or no gray mottles in the lower part. C horizons are reddish brown, weak red or dark reddish brown silt loam, loam, clay loam or silty clay loam with common to many gray mottles and few coarse fragments.

Competing Series and Their Differentiae: These include Mitan, Paegsan, Yongji, Jisan, Yuga, Buyeo and Imdong soils. The Mitan soils have clayey skeletal textures, are well drained and are formed in alluvial-colluvial materials in limestone areas. The Paegsan soils are less reddish brown, are well drained and are formed in alluvial-colluvial materials in granitic areas. The Yongji soils are less reddish brown, moderately well drained and are formed in alluvial-colluvial materials derived from granitic soils. The Jisan soils have grayer colors, poor drainage and are formed in local alluvium derived from granitic and andesite porphyry soils. The Imdong soils have coarse loamy textures, are well drained and contain gravel throughout the profiles. The Yuga soils have mottled brown and yellow colors, imperfect drainage and are formed in local alluvium derived from gray shale soils. The Buyeo soils are well drained, more acid and are formed in residual upland positions.

Setting: The Samam soils occur in gently sloping to sloping narrow local valley alluvial positions and are derived from alluvial-colluvial materials derived from red shale and sandstone soils. Dominant slopes are 2 to 7 percent and range from 2 to 15 percent.

Principal Associated Soils: These include the Buyeo, Habin and Imdong soils. The Buyeo and Habin soils occur in residual positions above the Samam soils. The Imdong soils occur in well drained local alluvial-colluvial positions between the Samam and residual upland soils.

Drainage and Permeability: The Samam soils are moderately well drained. Permeability is probably moderate. Runoff is artificially controlled as most areas are terraced for paddy rice cultivation.

Use and Vegetation: These soils are used for paddy rice during the wet summer and barley during dry winter and spring seasons.

Distribution and Extent: These soils are of small extent. They occur in the southeastern and southwestern parts of the country in association with the Buyeo and Habin soils and red sedimentary geologic materials.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Lab. Nos. Cg207-211 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 16	Ap1g	0.0	4.4	7.4	10.1	9.6	7.4	44.6	16.5	L	23.7	34.7	25.0	CL
16- 40	Ap2	0.0	4.8	7.7	10.4	9.3	7.2	44.0	16.6	L	24.6	33.5	25.3	CL
40- 65	B2	0.0	4.1	6.0	7.9	7.7	6.8	49.3	18.2	L	19.4	37.1	25.3	CL
65-100	B3	0.0	3.6	5.3	6.4	5.4	5.4	50.3	23.6	SiL	16.3	31.4	28.7	CL
100-105	C	4.5	3.5	7.3	8.5	6.3	6.7	53.5	14.2	SiL	20.5	35.9	29.4	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
						me/100g							
36.8	31.3	9.3	5.0	3.7	1.76	7.10	4.12	1.12	0.17	0.15	-	79.4	-
31.6	27.2	9.6	5.2	3.9	1.24	6.70	4.87	1.50	0.15	0.15	-	99.6	-
26.6	24.2	9.8	6.5	5.3	0.35	8.15	8.87	2.75	0.20	0.12	-	146.5	-
29.9	27.0	13.0	6.7	5.3	0.35	9.40	8.25	2.88	0.12	0.12	-	120.9	-
26.5	23.7	9.1	6.8	5.1	0.22	8.80	7.87	2.88	0.10	0.10	-	124.4	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
20 November, 1969

SAMGAG SERIES

The Samgag series is a member of the coarse loamy mixed, mesic family of Typic Dystrochrepts (Lithosols). These soils have thin brown sandy loam A horizons and moderately thick strong brown to yellowish brown sandy loam cambic B horizons. The C horizons are very thick strongly weathered brownish yellow sandy loam to loamy sand saprolite. They are developed in hilly and mountainous areas in residuum derived from granitic materials.

Typifying Pedon: Samgag rocky sandy loam - pine forest (Modified field description Ulsan profile No. 19; colors are for moist soil unless otherwise noted.)

A -- 0 to 12 cm. Very pale brown (10YR 7/3) when dry, light yellowish brown (10YR 6/4) when moist, sandy loam; moderate very fine and fine granular structure; friable, nonsticky and nonplastic; common fine yellowish mica; many fine and medium living and dead pine tree, wild grass and shrub roots; gradual smooth boundary; pH 4.5.

B1 -- 12 to 23 cm. Strong brown (7.5YR 5/6) coarse sandy loam; weak coarse and medium subangular blocky structure; slightly sticky and nonplastic; few very fine and fine discontinuous random inped simple tubular pores; mica as above; common fine and medium roots as above; clear smooth boundary; pH 5.0.

B2 -- 23 to 32 cm. Reddish yellow (7.5YR 6/6) fine gravelly coarse sandy loam; weak coarse and medium subangular blocky structure breaking readily to moderate granular; friable, nonsticky and nonplastic; pores as above; mica as above; few fine roots as above; gradual wavy boundary; pH 5.2.

C1 -- 32 to 65 cm. Reddish yellow (7.5YR 6/8) fine gravelly loamy sand; structureless (massive) breaking in hand to moderate granular; firm, nonsticky and nonplastic; mica as above; extremely weathered granite saprolite; diffuse wavy boundary; pH 5.5.

C2 -- 65 to 120 cm. Pale brown (10YR 6/3) as above with common fine and medium faint and distinct reddish yellow and strong brown mottles.

Type Location: Weolseong Gun, Gyeongsangbug Do, about 2 km. north of Hwalseong Ri, about 200 meters west of road, Wadong Myeon.

Range in Characteristics: Solum thickness is generally less than 50 cm. and ranges from about 30 to 75 cm. Depth to hard rock is more than 2 meters generally ranging from 5 to 10 meters or more. Base saturation is commonly medium but the range includes low. Reaction is strongly to medium acid. Fine angular quartz gravel may occur throughout the soil. Mica commonly occurs. Generally bedrock outcrops do not occur; however, in some geologic formations detached boulders and rock outcrops are present. The A horizons are generally absent but may be 5 to 15 cm. thick, brown to dark brown, where eroded dark yellowish brown, yellowish brown or pale brown sandy loam or coarse sandy loam. The cambic B horizons, 20 to 50 cm. thick, are reddish yellow, light brown, strong brown, brown or yellowish brown in hues 10YR or 7.5YR sandy loam, coarse sandy loam or light loam with less than 20 percent fine quartz gravel and weak blocky structure. The C horizons are dominantly pale brown, light brown or light yellowish brown sandy loam, coarse sandy loam, loamy coarse sand or coarse loam, very thick and strongly weathered residual granitic saprolite. Occasional loose boulders may be in this horizon. The boundary of the C horizon over bedrock is very gradual, wavy or irregular.

Competing Series and Their Differentiae: These are the Weoljeong, Gwanag, Songjeong, Chahang, Mudeung and Andong series. The Weoljeong soils have dark colored A horizons. The Gwanag soils have hard bedrock within 50 cm. of the surface. The Chahang soils have dark colored (Umbric) A horizons and fine loamy textures. The Mudeung soils have fine loamy textures and hard bedrock within 50 cm. of the surface. The Andong soils have sandy family textures and granitic parent materials.

Setting: The Samgag soils occur on hills, low mountains and the lower parts of some high mountains, chiefly in areas of granitic geology and very thick saprolite, developed below old and very old base levels. Slopes range from 7 to 100 percent or more but 30 to 60 percent slopes are dominant.

Principal Associated Soils: The Songjeong, Jeonnam, Dalcheon and Andong soils are associated with the Samgag soils on similar parent materials in upland positions. The Samgag and Andong soils generally occupy the more exposed, eroded and steeper landscape positions.

Drainage and Permeability: Somewhat excessively drained. Permeability is moderately rapid. When the soil is saturated, the runoff is rapid or very rapid depending on the slope.

Use and Vegetation: Most of these soils grow poor pine forest. Some small areas are cultivated for barley, soybean, potato, sweet potato, red pepper, tobacco, melon, sesame and similar nonirrigated crops.

Distribution and Extent: The Samgag soils are of large extent and are distributed throughout the country in hilly areas over deeply weathered granite and granite gneiss parent materials.

Series Established: Gwangju Si, Jeollanam Do, 1967.

Samgag Series Contd.

Lab. Nos. U138-141 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Hori-zon	Gra-vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0-12	A	11.4	15.4	20.0	12.0	8.9	3.5	30.0	10.2	CoSL	49.7	20.8	19.3	CoSL
12-23	B1	13.1	14.3	22.6	13.7	10.2	4.4	27.0	7.8	CoSL	53.3	17.8	21.1	CoSL
23-32	B2	12.5	20.7	23.3	11.5	9.0	4.9	23.8	6.8	CoSL	57.7	22.1	13.4	CoSL
32-65	C1	18.1	22.5	25.4	11.8	8.0	4.1	20.5	7.7	CoSL	61.5	15.6	15.2	CoSL

Moisture Retention %			S.G.	Atterberg Limits %		pH		O.M.	Avail	2/	Extractable Cations				
1/10 atms	1/3 atms	15 atms		LL	PI	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H
										me/100g					
	20.7	9.5	2.61	31.0	8.0	4.7	3.6	0.60	8	4.60	0.20	0.00	0.09	0.13	-
	19.3	7.5	2.64	33.0	8.0	5.2	3.8	0.40	2	5.30	0.05	0.10	0.19	0.06	-
	20.2	8.4	2.70	-	-	5.3	3.6	0.30	2	4.60	0.05	0.75	0.36	0.06	-
	18.7	8.6	2.64	39.0	14.0	5.4	3.7	0.10	-	5.00	0.15	1.60	0.33	0.08	-

Base Saturation %		Elemental Analysis of Clay			
CEC	Sum of Cations	SiO_2/ R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %
9.1	-	2.07	52.39	7.57	38.11
7.5	-	2.32	56.76	5.62	37.78
26.5	-	2.20	55.76	5.35	39.53
43.2	-	1.96	54.98	5.12	44.26

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

SANGJU SERIES

The Sangju series is a member of the coarse loamy, mixed, mesic family of Dystric Fluventic Eutrochrepts (Alluvial soils). These soils have moderately thick brown fine gravelly sandy loam Ap horizons and deep dark yellowish brown fine gravelly sandy loam cambic B horizons. C horizons are weakly stratified yellowish brown fine gravelly sandy loam, coarse sandy loam or loam. They are developed in local alluvium and colluvial in local valley footslope positions in materials derived from coarse textured light colored granitic soils.

Typifying Pedon: Sangju fine gravelly sandy loam - soybean (Field description Sangju profile No. 79; colors are for moist soil unless otherwise noted.)

Ap -- 0 to 10 cm. Pale brown (10YR 6/3) dry, dark yellowish brown (10YR 4/4) fine gravelly sandy loam; weak fine and medium granular structure; friable, slightly sticky and nonplastic; many very fine to fine discontinuous random inped tubular pores; common fine white mica flakes; about 20 percent fine unweathered angular quartz gravel; common fine living soybean roots; abrupt smooth boundary.

A1 -- 10 to 20 cm. Dark yellowish brown (10YR 4/4) fine gravelly coarse sandy loam; weak fine medium and some coarse granular structure; friable, slightly sticky and nonplastic; common very fine to fine discontinuous inped closed tubular pores; quartz gravel as above; mica as above; common very fine to fine living and dead roots; gradual smooth boundary.

B -- 20 to 60 cm. Dark yellowish brown (10YR 3/4) fine gravelly coarse sandy loam; weak fine, medium and coarse granular and some weak subangular blocky structure; slightly firm, slightly sticky and nonplastic; less than 10 percent quartz gravel as above; common medium exped and random tubular pores; few very fine dead grass roots; clear smooth boundary.

C1 -- 60 to 75 cm. Dark yellowish brown (10YR 4/4) loamy coarse sand; weak granular structure; loose nonsticky and nonplastic; few quartz gravel as above; less pores than above; less roots than above; clear smooth boundary.

C2 -- 75 to 110 cm. Dark brown (10YR 3/3) fine gravelly coarse sandy loam; structureless (massive); slightly firm, slightly sticky and nonplastic; common fine and medium discontinuous exped tubular pores; roots as above; about 10 percent fine gravel as above; clear smooth boundary.

C3 -- 110 to 150 cm. Light yellowish brown (10YR 6/4) fine gravelly loam; structureless (massive); slightly firm, slightly sticky and nonplastic; fine gravel as above and few angular cobbles; few medium discontinuous inped random tubular pores; no roots.

Type Location: Sangju Gun, Gyeongsangnam Do, 1 km. east of Sinbong Ri, (between Hwayeong and Seocheonggo Ri), Hwaseo Myeon.

Range in Characteristics: Depth of solum ranges from 50 to 100 cm. Depth to saprolite is about 200 cm. and depth to hard rock is more than 3 meters. Reaction is very strongly to strongly acid in the Ap horizon except where limed and medium to slightly acid in the B and C horizons, increasing slightly with depth. About 10 to 35 percent fine angular quartz gravel is throughout the soil. Base saturation is more than 60 percent throughout the soil though it appears from limited data, to vary considerably. Ap horizons are 15 to 25 cm. thick, dark yellowish brown, brown to dark brown, strong brown or yellowish brown fine gravelly sandy loam, fine sandy loam, loam, loamy sand or coarse sandy loam. Cambic B horizons are dark yellowish brown, yellowish brown, brownish yellow, light yellowish brown or strong brown fine gravelly sandy loam, loam, fine sandy loam or coarse sandy loam. B horizon hues are chiefly 10YR. C horizons are weakly stratified dark yellowish brown, brown, yellowish brown or brownish yellow fine gravelly loamy sand, loamy coarse sand, coarse sandy loam, sandy loam or loam. Buried soil may underlie the solum.

Competing Series and Their Differentiae: These are the Imdong, Mui, Weondang, Seongsan, Jungdong, Tongcheon, Ibseog, Paegsan and Iweon soils. The Imdong soils have reddish brown colors, less acid reaction and reddish brown shale and sandstone soil parent materials. The Mui soils have dark (umbric) epipedons and occur in dissected mountain colluvium. The Weondang soils have yellowish red or red colors and fine loamy textures. The Seongsan soilshave redder colors and are free of gravel throughout. The Jungdong soils have gravel free fine sandy loam textures and occur on broad alluvial plains. The Tongcheon soils have gray drainage mottles between 50 and 100 cm. depths and occur on alluvial plains. The Ibseog soils have fine gravelly sandy skeletal textures. The Paegsan soils are in the fine loamy texture family and are gravel free. The Sachon soils have gray mottles and ground water tables between 50 and 100 cm. depths. The Iweon soils contain gravel, stone and boulders throughout the profiles.

Setting: The Sangju soils occur on gently sloping to sloping undissected or slightly dissected local alluvial-colluvial footslope and alluvial fan positions and are formed in weakly stratified materials washed from coarse textured granitic soils. Slopes range from 2 to 30 percent and 2 to 7 percent slopes are dominant.

Principal Associated Soils: In similar positions the Togye soils are associated. The Bonryang and Tongcheon soils are commonly on the flood plains below the Sangju soils. The Sachon soils are associated in the lower lying local valley alluvial plains. The Samgag and Andong soils are generally associated at higher elevation and provide the source materials for the Sangju soils.

Sangju Series Contd.

Drainage and Permeability: Well drained. Permeability is probably moderately rapid and runoff is medium depending on slope gradient. Depth to the watertable is more than 200 cm.

Use and Vegetation: Most of the Sangju soils are used for barley, soybean, sesame, red pepper, mulberry, tobacco and similar upland crops. Some areas produce persimmon, chestnut, jujube, grape and apple.

Distribution and Extent: Sangju soils are of moderate extent and are distributed in the southern part of the country where coarse textured granitic soils occur.

Series Established: Sangju Gun, Gyeongsangnam Do, Nov. 1968.

Remarks:

Lab. Nos. Fr164-169 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm.	Hori-zon	Gra-vel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 10	Ap	18.0	9.1	14.7	20.6	17.0	9.5	22.9	6.2	SL	47.0	35.5	11.3	CoSL
10- 20	A1	17.9	11.3	14.8	20.2	16.3	8.9	20.7	7.8	CoSL	49.1	31.2	11.9	CoSL
20- 60	B	9.8	12.1	16.4	20.8	15.3	6.9	17.3	11.2	CoSL	52.1	23.0	13.7	CoSL
60- 75	C1	7.6	8.6	24.0	28.7	13.8	4.6	13.1	7.2	LCoS	64.1	19.7	9.0	LCoS
75-110	C2	12.2	13.1	16.9	19.6	12.5	5.9	22.4	9.6	CoSL	52.0	22.6	15.8	CoSL
110-150	C3	11.0	12.1	13.7	11.8	8.3	5.6	36.7	11.8	L	38.7	22.2	27.3	L

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
	14.9	5.4	4.5	3.6	1.08	196	6.50	2.40	1.20	0.08	0.50	1.06	64.3	79.8
	15.1	5.7	4.6	3.5	1.08	202	6.45	2.15	1.15	0.15	0.20	1.56	56.6	70.1
	14.6	6.4	5.7	4.1	0.54	14	5.25	5.15	2.45	0.23	0.10	0.20	150.6	97.5
	11.8	5.2	5.9	4.4	0.43	17	6.10	3.75	1.25	0.15	0.08	0.10	85.7	98.1
	16.6	6.4	6.1	4.4	0.43	17	7.00	4.10	1.35	0.10	0.05	0.05	80.0	99.1
	20.4	7.2	6.1	4.2	0.32	8	7.25	4.05	0.95	0.20	0.08	0.10	72.8	98.1

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
20 November, 1969

SEOGGYE SERIES

The Seoggye series is a member of the coarse loamy, mixed, nonacid, mesic family of Aeric Fluventic Haplaquepts (Low Humic Gley soils). They have moderately thick dark grayish brown sandy loam Apg horizons and moderately deep prominently mottled sandy loam cambic B horizons. Cg horizons are dark gray loamy sand. They are formed on nearly level alluvial plains in mixed continental alluvial materials.

Typifying Pedon: Seoggye sandy loam - paddy rice (Field description Ulju Gun profile No. 75; colors are for moist soil.)

Ap1g -- 0 to 8 cm. Dark grayish brown (2.5Y 4/2) sandy loam; few fine and medium distinct strong brown (7.5YR 5/6) mottles; crushed color dark grayish brown (2.5Y 4/2); puddled structure; dries and breaks to weak fine and medium granular; friable, slightly sticky and slightly plastic; many fine and very fine white mica flakes; common fine and medium dead rice roots; abrupt smooth boundary; pH 5.6.

Ap2g -- 8 to 19 cm. Dark gray (5Y 4/1) sandy loam; few fine and medium distinct reddish brown (7.5YR 6/6) mottles; crushed color dark grayish brown (2.5Y 4/2); weak coarse platy and weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; few fine mica flakes; discontinuous random closed vertical tubular pores; few fine and medium roots as above; gradual smooth boundary; pH 6.2.

A3g -- 19 to 26 cm. Dark gray (N4/) sandy loam; common very fine and fine distinct strong brown and reddish yellow mottles; crushed color very dark grayish brown (2.5Y 3/2); weak fine to coarse subangular blocky structure; firm, slightly sticky and slightly plastic; mica as above; many fine and medium discontinuous vertical inped simple tubular pores; no roots; clear wavy boundary; pH 6.3.

B1g -- 26 to 35 cm. Dark gray (5Y 4/1) coarse sandy loam; many fine to coarse prominent strong brown (7.5YR 5/6) mottles; crushed color dark yellowish brown (10YR 4/4) weak coarse blocky structure; firm, slightly sticky and slightly plastic; mica as above; common fine to medium discontinuous random inped closed tubular pores; gradual wavy boundary; pH 6.5.

B2 -- 35 to 62 cm. Mottled dark yellowish brown (10YR 4/4) and very dark grayish brown (2.5Y 3/2) coarse sandy loam; crushed color olive brown (2.5Y 4/4); weak coarse blocky structure breaking to medium granular; mica as above; firm, slightly sticky and nonplastic; few pores as above; abrupt wavy boundary; pH 6.6.

Cg -- 62 to 100 cm. Dark gray (5Y 4/1) loamy sand; structureless (single grain); loose, nonsticky and nonplastic; mica as above; no pores; pH 6.5.

Type Location: Weolseong Gun, Gyeongsangbug Do, about 1 km. northwest of Ipsil Ri, Oedong Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth over hard rock is probably more than 3 meters. Base saturation is more than 60 percent. Reaction is medium to slightly acid. Less than 10 percent gravel and few to many fine to very fine mica flakes occur throughout the profile. Apg horizons are 20 to 30 cm. thick, grayish brown, dark grayish brown or gray sandy loam, loam or silt loam with mottles. Cambic B horizons are prominently mottled grayish brown, dark gray, olive gray, gray and strong brown, yellowish red, red, reddish brown or yellowish brown sandy loam, loam or silt loam. Cg horizons are grayish brown, gray, dark gray or olive gray loamy sand, sand or loamy coarse sand with few or no mottles.

Competing Series and Their Differentiae: These are the Bonryang, Tongcheon, Subug, Jungdong, Nagdong, Manseong, and Gangdong soils. The Bonryang soils have coarse loamy textures, brown colors and are well drained. The Tongcheon soils have loamy skeletal textures and are moderately well drained. The Subug soils have coarse loamy over sandy skeletal textures. The Jungdong and Nagdong soils have brown colors and are well drained. Manseong soils have fine loamy over sandy textures. The Gangdong soils have fine loamy over sandy textures and are poorly drained.

Setting: The Seoggye soils occur on nearly level very gently sloping continental alluvial plains and alluvial fans and are derived from stratified alluvial materials. Dominant slopes are about 1.0 percent and the range is from 0 to 2 percent.

Principal Associated Soils: The Tongcheon, Sindab, Manseong and Nagdong soils are associated. The Sindab soils have sandy textures and poor drainage.

Drainage and Permeability: Imperfectly drained. Permeability is probably moderate to moderately rapid. Runoff is slow as there is very little slope and most areas are level terraced for paddy rice production.

Use and Vegetation: Most areas are used for flood irrigated rice during wet summers and nonirrigated barley during the winter and spring seasons.

Distribution and Extent: The Seoggye soils are of small extent and occur along streams mostly in the southern part of the country.

Series Established: Ulsan City, Gyeongsangnam Do, 1966.

Lab. Nos. U427-432 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) %: U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 8	Ap1g	3.3	3.2	6.3	8.5	2b.3	19.0	29.3	13.4	SL	21.9	49.1	15.6	FSL
8- 19	Ap2g	3.7	4.2	8.1	9.6	21.4	18.0	27.3	11.4	SL	25.7	46.7	16.2	FSL
19- 26	A3g	4.7	4.7	9.7	11.8	19.5	12.9	27.5	13.9	SL	30.0	40.9	15.2	FSL
26- 35	B1g	3.1	4.9	10.0	12.7	21.6	15.3	25.7	9.8	SL	32.3	44.8	13.1	FSL
35- 62	B2	5.9	5.6	11.1	14.3	23.9	14.9	22.9	7.3	SL	35.9	47.6	9.2	FSL
62-100	Cg	7.8	6.3	14.9	20.5	23.1	13.4	18.2	3.6	LS	48.4	40.5	7.5	LCoS

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	Free Fe_2O_3 %	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Sat. %: CEC	Sum of Cations
	29.6	12.0	5.2	3.9	3.10	0.40	9.60	6.10	1.90	0.21	0.09	-	86.5	-
	25.9	10.0	5.2	3.9	2.50	0.41	10.40	5.30	1.80	0.04	0.10	-	69.6	-
	20.7	8.4	5.6	4.2	1.80	0.63	7.80	4.80	1.60	0.21	0.13	-	86.4	-
	21.2	8.1	5.8	4.4	1.00	1.89	7.20	4.75	1.00	0.11	0.14	-	83.3	-
	16.2	5.8	6.1	4.4	0.60	0.99	7.10	5.00	1.60	0.04	0.14	-	97.3	-
	11.1	4.6	5.8	3.9	0.70	0.44	5.20	3.40	1.00	0.14	0.13	-	89.8	-

Elemental Analysis of Clay: SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %
-	-	-	-
2.59	55.80	9.24	30.68
-	-	-	-
-	-	-	-
2.11	49.17	16.22	29.21

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

SEOGTO SERIES

The Seogto series is a member of the loamy-skeletal, mixed, mesic family of Dystric Fluventic Eutrochrepts (Regosols). These soils have moderately thick brown to dark brown gravelly to stony silt loam A horizons and moderately deep yellowish brown very gravelly, cobbly or stony silty clay loam cambic B horizons. The C horizons are deep yellowish brown very gravelly, cobbly or stony silt loam developed in mountain colluvium derived from acidic crystalline materials such as andesite porphyry and granite.

Typifying Pedon: Seogto gravelly silt loam - Indian millet (Field description Gwangsan Gun profile No. 114; colors are for moist soil.)

Ap -- 0 to 10 cm. Brown to dark brown (10YR 4/3) gravelly silt loam; moderate fine and medium granular structure; friable, slightly sticky and slightly plastic; approximately 15 to 35 percent unweathered angular andesite porphyry gravel and cobbles; common fine and medium discontinuous random interstitial pores; common fine roots; gradual smooth boundary.

B1 -- 10 to 19 cm. Yellowish brown to brown (10YR 5/3.5) very gravelly silty clay loam; weak fine to medium subangular blocky and moderate fine and medium granular structure; friable, sticky and plastic; approximately 35 to 50 percent gravel and cobbles as above; common fine to medium discontinuous random inped interstitial pores; few worm casts, few fine roots; clear smooth boundary.

B2 -- 19 to 34 cm. Yellowish brown (10YR 5/4) very gravelly to cobbly silty clay loam; weak fine to medium subangular blocky and some granular structure; friable, sticky and plastic; gravel and cobbles as above; few angular stones; few fine and medium discontinuous random inped tubular pores; few fine roots; clear smooth boundary.

B3 -- 34 to 52 cm. Yellowish brown (10YR 5/6) very gravelly to cobbly silty clay loam; weak fine and medium subangular blocky and moderate medium granular structure; friable, sticky and plastic; gravel, cobbles and stones as above; few fine discontinuous random inped interstitial pores; few fine roots; clear smooth boundary.

C -- 52 to 80 cm. Mottled brown to dark brown (7.5YR 4/2), pale brown (10YR 6/3) and very dark brown (10YR 2/2) very gravelly cobbly and stony silty clay loam; crushed color yellowish brown (10YR 5/6); structureless (massive); slightly firm, slightly sticky and slightly plastic; few fine discontinuous inped pores; approximately 80 percent coarse fragments.

Type Location: Gwangju City, Jeollanam Do, about 50 meters south of Jiwan Dong (Hwasan Ri).

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is more than 2 meters. Though the base saturation of the solum is variable it is mainly more than 60 percent and increases somewhat below 125 cm. Reaction is strongly to medium acid. These soils contain between 35 to 90 percent gravel, cobbles and stones throughout, which generally increase with depth. The control section contains between 18 to 35 percent clay. Ap or A1 horizons are 15 to 25 cm. thick, brown dark brown or dark yellowish brown gravelly, cobbly or stony silt loam or light silty clay loam. Cambic B horizons are yellowish brown, brown, dark yellowish brown, light yellowish brown, brownish yellow or light brown mostly very gravelly, very cobbly or very stony light silty clay loam, silt loam, loam or light clay loam. C horizons are yellowish brown, brownish yellow or brown very gravelly, very cobbly, very stony or bouldery stratified silt loam or loam.

Competing Series and Their Differentiae: These are the Sinbul, Maji, Mangsil, Banho, Gaghwa, Iweon and Anyong series. The Sinbul soils have thick dark colored A horizons. The Maji soils have dark A horizons, near neutral reaction and limestone parent materials. The Mangsil soils contain less gravel and cobbles and have argillic Bt horizons. The Banho soils contain less gravel and generally occur in gray shale areas. The Gaghwa soils have redder colors, less coarse fragments and argillic Bt horizons. The Iweon soils have coarse loamy textures and contain less cobbles and stones. The Anyong soils contain less coarse fragments and have argillic Bt horizons.

Setting: The Seogto soils are formed in strongly sloping to steep stony mountain colluvium in narrow valleys and footslopes in soil materials derived dominantly from weathered acidic crystalline rocks. Dominant slopes are 15 to 30 percent and the range is from 10 to 60 percent.

Principal Associated Soils: The Iweon, Anyong, Gaghwa, Hogye, Jangweon, Sinbul, Mudeung and Taehwa soils are associated with Seogto series. The Iweon, Jangweon, Hogye and Gaghwa soils are usually associated in lower alluvial-colluvial fan physiographic positions. The Mudeung and Taehwa soils occur on higher residual slopes. The Sinbul soils and Talus occupy similar positions on slopes above the Seogto soils.

Drainage and Permeability: Well drained. Permeability is moderate and runoff is moderately rapid to rapid depending on the slope gradient.

Use and Vegetation: About half of these soils are used for corn, soybean, tobacco, Indian millet, red bean, red pepper and similar nonirrigated crops. The remainder grows forest, wild grass and wild scrub.

Distribution and Extent: The Seogto soils are of moderate extent and are distributed in steep narrow mountain valleys in the acidic crystalline areas throughout the country.

Series Established: Gwangsan Gun, Jeollanam Do, 1967.

Remarks: Clay increase in B horizons as indicated in the analytical data of the typifying pedon is not characteristic of the series, although some stratification of materials is normal.

Lab. Nos. K284-288 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0-10	Ap	35.8	1.7	4.2	4.5	4.5	2.3	58.0	24.8	SiL	11.5	22.8	40.9	CL
10-19	B1	23.8	1.6	3.8	3.9	2.9	1.0	55.7	31.1	SiCL	10.3	19.4	39.2	LiC
19-34	B2	17.3	—3.7—		3.0	3.2	2.2	55.4	32.4	SiCL	7.5	17.7	42.4	LiC
34-52	B3	9.4	—3.8—		3.2	3.9	2.9	59.7	26.5	SiL	7.8	24.5	41.2	LiC
52-80	C	22.4	1.1	3.7	4.8	6.1	4.3	62.1	17.9	SiL	10.9	26.5	44.7	CL

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
	32.5	13.1	4.8	3.6	3.40	116	8.94	2.90	1.20	0.24	0.20	-	50.6	-
	31.3	15.5	4.8	3.6	1.41	37	9.22	2.20	0.40	0.12	0.12	-	30.8	-
	32.0	14.4	5.0	3.6	2.52	-	8.72	1.60	0.30	0.32	0.12	-	26.5	-
	32.3	12.7	4.9	3.5	0.94	-	7.70	1.80	0.90	0.26	0.12	-	40.3	-
	30.7	9.9	5.3	3.6	0.42	-	12.86	5.00	3.50	0.28	0.12	-	68.5	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, KPJ, JFD
17 November, 1969

SEONGSAN SERIES

The Seongsan series is a member of the coarse loamy mixed, mesic family of Dystric Fluventic Eutrochrepts (Alluvial soils). These soils have moderately thick brown to dark brown sandy loam Ap horizons and deep strong brown or yellowish red sandy loam cambic B horizons. C horizons are very deep brown sandy loams weakly stratified. They are developed on slightly or undissected very gently sloping to sloping relief in local alluvial-colluvial materials in granitic areas.

Typifying Pedon: Seongsan sandy loam - barley (Field description Damyang Gun profile No. 10; colors are for moist soil.)

Ap -- 0 to 17 cm. Brown (7.5YR 5/4) sandy loam; weak fine granular structure; friable, nonsticky and nonplastic; few fine white mica flakes; few fine barley roots; abrupt smooth boundary.

B1 -- 17 to 67 cm. Strong brown (7.5YR 5/8) sandy loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; common fine mica flakes; few fine random exped pores; few fine barley roots; abrupt smooth boundary.

B2 -- 67 to 100 cm. Strong brown (7.5YR 5/8) sandy loam; weak fine and medium subangular blocky structure; friable, nonsticky and nonplastic; no roots; pores as above.

B3 -- 100 to 130 cm. Brown (7.5YR 5/4) sandy loam as above with common soft dark brown (7.5YR 3/2) mottles.

Type Location: Damyang Gun, Jeollanam Do, about 1 km. south of Jigog Ri, Changpyeong Myeon.

Range in Characteristics: Solum thickness ranges from 100 to 150 cm. and depth to weathered bedrock is commonly more than 2 meters. Base saturation varies considerably and is considered to be mainly more than 60 percent. Reaction is very strongly to slightly acid increasing with depth. Less than 10 percent fine gravel may be present. Ap horizons are 15 to 25 cm. thick, brown to dark brown, reddish brown or strong brown sandy loam or loam. The cambic B horizons are yellowish red, reddish brown, reddish yellow and strong brown sandy loam or loam with weak blocky structure. B horizons have hues of 7.5YR and 5YR. The C horizons are yellowish red, strong brown or reddish brown stratified loam or sandy loam with granular structure. Buried profiles with similar textures and B horizon development are below 100 cm. in some places. Thin strata of silt loam, silty clay loam, sandy clay loam or coarse sandy loam may occur.

Competing Series and Their Differentiae: These include the Imdong, Mui, Sangju, Weondang, Baegsan, Iweon, Bansan, Togye and Ibseog series. The Imdong soils contain 10 to 35 percent gravel, have reddish brown colors and are in areas of reddish brown shale and sandstone. The Mui soils have umbric epipedons, yellowish brown colors and occur in dissected mountain colluvium and colluvial fans. The Weondang soils have yellowish red or red colors and fine loamy texture. The Sangju soils have yellowish brown colors and fine gravelly sandy loam textures. The Baegsan soils have yellowish brown colors and fine loamy textures. The Iweon soils have gravel and stones throughout the profiles. The Bansan soilshave darker A horizons and fine clayey argillic B horizons. The Togye soils are in the sandy texture family and contain fine gravel throughout. The Ibseog soils are in the sandy skeletal texture family.

Setting: The Seongsan soils occur on gently sloping to sloping relief in colluvial- alluvial positions in granitic areas in association with fine textured red upland soils. Slopes range from 2 to 15 percent and dominant slopes are 2 to 7 percent.

Principal Associated Soils: These include the Sachon, Yongji, Bansan, Baegsan, Jeonnam, Gwangsan, Iweon, Togye, Ibseog, Sangju and Samgag soils. The Yongji and Sachon soils contain gray drainage mottles and occur in somewhat lower physiographic positions with higher watertables. The Gwangsan and Jeonnam soils have finer textures, argillic B horizons and occur in well drained upland positions. The coarse loamy Samgag soils occur in residual upland positions above the Seongsan soils. The Bansan, Baegsan, Togye, Ibseog, Sangju soilsoccur in similar physiographic positions. The Iweon soils occur in slightly more elevated positions associated with higher hills and mountains.

Drainage and Permeability: Well drained. Permeability is moderately rapid and runoff is medium. The water table in probably below 2 meters.

Use and Vegetation: Most areas are cultivated for upland crops such as barley, wheat, onion, lettuce, melon, watermelon,soybean, cotton and tobacco.

Distribution and Extent: The Seongsan soils are of moderate extent, occur in many small areas and are distributed throughout the country in the granitic areas where red upland soils occur.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Lab. Nos. Ee38-40 Typifying Pedon

Depth cm	Hori- zon	Gra- vel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1- .5	MS .5- .25	FS .25- .10	VFS .10- .05	Silt .05- .002	Clay <002	Tex- tural Class	International CS 2- .2	FS .2- .02	Silt .02- .002	Tex- tural Class
0- 17	Ap	5.7	6.6	10.5	13.0	14.0	12.9	31.1	11.9	SL	32.5	36.7	18.9	SL
17- 67	B1	9.2	12.1	12.0	12.9	15.7	14.3	22.1	10.9	SL	39.5	37.1	12.5	SL
67-100	B2	7.5	8.4	11.7	13.8	15.8	14.2	24.5	11.6	SL	36.6	37.0	14.8	SL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg me/100g	Na	K	H	Base Sat. % CEC	Sum of Cations
	21.0	7.8	5.5	3.9	1.17	9.35	2.15	1.27	0.08	0.05	0.55	38.0	86.6
	15.3	6.2	5.5	3.9	0.48	7.40	1.82	1.12	0.30	0.25	1.75	47.2	66.6
	17.7	6.8	5.5	3.9	0.45	8.55	1.47	2.30	0.10	0.05	1.45	45.8	73.0

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
17 November, 1969

SINBUL SERIES

The Sinbul series is a member of the loamy-skeletal, mixed, mesic family of Typic Haplumbrepts (Acid Brown Forest soils). These soils have moderately thick very dark grayish brown stony loam A horizons and moderately deep yellowish brown very stony silty clay loam cambic B horizons. The C horizons are yellowish brown relatively unweathered very stony silty clay loam. They occur in high mountainous areas and are formed in colluvial materials derived from porphyritic and granitic soils.

Typifying Pedon: Sinbul stony silt loam - wild grass (Field description Ulju Gun profile No. 115; colors are for moist soil.)

A -- 0 to 26 cm. Very dark grayish brown (10YR 3/2) angular cobbly to stony silty clay loam; strong fine and coarse granular structure; friable, slightly sticky and slightly plastic; 10 to 30 percent fresh or slightly weathered angular porphyry gravel, cobbles and stones; many fine to coarse living and dead grass, shrub and oak tree roots; abrupt wavy boundary; pH 5.3.

B -- 26 to 80 cm. Yellowish brown (10YR 5/4) very cobbly to very stony clay loam; weak fine subangular blocky and medium granular structure; firm, slightly sticky and slightly plastic; about 60 to 70 percent stones, cobbles and gravel as above; no roots; pH 4.5.

C -- 80 to 100 cm. Pale brown (10YR 6/3) very stony silt loam more or less as above except for about 75 percent coarse fragments.

Type Location: Ulju Gun, Gyeongsangnam Do, about 1 km. southeast of Icheon Ri, Sangbug Myeon.

Range in Characteristics: Solum thickness is 50 to 100 cm. and depth to bedrock is commonly more than 3 meters. Base saturation is generally less than 60 percent. Reaction is strongly to medium acid. 35 to 90 percent gravel, stones and cobbles occur in the control section. Boulders and few bedrock outcrops may occur. A horizons are 20 to 30 cm. thick, dark brown, very dark brown or very dark grayish brown silt loam, silty clay loam or loam with various amounts of gravel, cobbles, stones and boulders. Cambic B horizons are brown, yellowish brown, strong brown or dark yellowish brown clay loam, silty clay loam, heavy loam or silt loam with 35 to 90 percent gravel, cobbles, stones and/or boulders. C horizons are yellowish brown, strong brown or dark yellowish brown loam, silt loam, sandy loam, silty clay loam or clay loam with 35 to 90 percent unweathered gravel, cobbles, stones, boulders and few or no bedrock outcrops.

Competing Series and Their Differentiae: Competing soils are the Seogto, Mui, Mangsil, Maji and Ungyo series. The Seogto soils lack dark colored (umbric) epipedons. The Mui soils have coarse loamy textures, less coarse fragments and occur in dissected mountain colluvial footslope positions. The Mangsil soils have argillic horizons, contain less coarse fragments and more clay. The Maji soils have near neutral reaction, high base saturation and limestone parent materials. The Ungyo soils have argillic B horizons, redder colors and occur in dissected mountain colluvial footslope positions.

Setting: The Sinbul soils occur on steep to very steep high mountain tops, sides and footslopes and are formed in stony colluvial soil materials derived from granitic and porphyritic rocks. The climate is cool and moist. Dominant slopes are 30 to 60 percent and slope ranges from 7 to 100 percent.

Principal Associated Soils: These are the Mudeung, Mangsil, Odae, Ungyo, Seogto and Taehwa soils. The Mangsil and Odae soils occur in residual positions at high elevations. The Mudeung and Taehwa soils are in residual positions on mountain sides with warmer climate, below the Sinbul soils. The Ungyo and Seogto soils occur in colluvial positions below the Sinbul soils.

Drainage and Permeability: Well drained. Permeability is moderate to moderately rapid. Runoff is slow because of high organic matter content and rapid permeability in the A horizons. When saturated, runoff and lateral movement of water through the soil may be rapid.

Use and Vegetation: Most areas grow forest in northern parts of the country and wild grass or wild grass mixed with scrub bush and scattered trees in southern areas.

Distribution and Extent: The Mangsil soils are of small extent and are distributed in high mountainous areas in colluvial landscape positions in materials derived chiefly from granite, porphyry and similar materials.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966.

Remarks: The Sinbul soils are more or less equivalent to the Seogto soils except for having an umbric epipedon.

Lab. Nos. U585-586 Typifying Pedon

Depth cm	Hori- zon	Gra- vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex- tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0-26	A	25.9	3.1	5.4	5.6	4.8	2.5	51.2	27.4	SiL	15.3	10.9	41.4	LiC
26-80	B	29.7	7.3	11.0	8.0	5.1	2.3	37.6	28.7	CL	27.7	8.0	35.6	LiC

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Sat. %: CEC	Sum of Cations
	39.5	20.1	5.2	4.2	4.90	8	8.18	3.20	0.70	0.14	0.40	-	54.0	-
	26.9	12.6	5.8	4.2	1.12	5	8.80	3.00	0.80	0.28	0.32	-	50.0	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
17 November, 1969

SINDAP SERIES

The Sindab series is a member of the mixed, mesic, sandy family of Typic Psammaquents (Alluvial soils). These soils have thin gray to olive brown or dark grayish brown fine gravelly loamy coarse sand Ap horizons and deep fine gravelly coarse sand Cg horizons. They occur on level to very gently sloping alluvial plains, are formed in alluvial materials and are mostly in granitic areas.

Typifying Pedon: Sindab fine gravelly coarse sand - rice paddy (Field description Sangju Gun profile No. 196; colors are for moist soil.)

Ap -- 0 to 12 cm. Olive brown (2.5Y 4/4) fine gravelly coarse sand; common coarse faint grayish brown (2.5Y 5/2) mottles; crushed color light olive brown (2.5Y 5/4); structureless (single grain); loose, nonsticky and nonplastic; about 20 percent quartz grit; common fine roots; gradual smooth boundary; pH 6.5. See remarks.

C1g -- 12 to 40 cm. Olive gray (5Y 4/2) fine gravelly coarse sand; structureless (single grain); loose, nonsticky and nonplastic; about 15 percent quartz grit; few fine roots; gradual smooth boundary; pH 6.0.

C2g -- 40 to 80 cm. Light olive gray (5Y 6/2) fine gravelly coarse sand; structureless (single grain); loose nonsticky and nonplastic; about 10 percent quartz grit; few fine roots; diffuse smooth boundary; pH 6.5.

Type Location: Sangju Gun, Gyeongsangnam Do, about 1 km. west of Gungye (Ogsan village) Dong, Gongseong Myeon.

Range in Characteristics: Depth over strongly contrasting layers is more than one meter and depth over hard rock is 3 to 5 meters or more. Base saturation is more than 60 percent. Reaction is medium to strongly acid. 10 to 35 percent quartz grit occurs throughout the profiles. Ap horizons are 10 to 25 cm. thick, grayish brown, dark grayish brown, olive brown, gray or light gray sand, loamy sand, coarse sand or sandy loam. Cg horizons are commonly shades of gray, grayish brown, light olive gray or dark gray fine gravelly sand, loamy sand, coarse sand or loamy coarse sand. Thin strata of other textures may occur. In general textures are coarser with depth.

Competing Series and Their Differentiae: These are the Hamchang, Gangdong, Subug, Hwabong, Hwangryong and Nagdong series. The Hamchang soils have coarse loamy textures. The Gangdong soils have fine loamy over sandy textures. The Subug soils have coarse loamy textures, browner colors and imperfect drainage. The Hwabong soils have coarse sandy textures, lack gray colors and are somewhat excessively drained. The Hwangryong soils have sandy skeletal textures, lack gray mottles and are excessively drained. The Nagdong soils have fine sandy textures, lack gray mottles and are somewhat excessively drained.

Setting: The Sindab soils are formed in coarse textured sandy alluvium on alluvial plains, frequently in old stream channels and also in areas adjacent to dyked stream channels where the stream bed is higher than the alluvial plains. They also occur in narrow valley alluvium and below lakes commonly where seepage water and springs occur. Dominant slopes are about 1 percent and slope range is from 0.0 to 7.0 percent.

Principal Associated Soils: The Seongsan, Togye, Sangju and Ibseog soils may be associated in local alluvial positions above the Sindab soils. The Hwangyong and Hwabong soils are associated in river levee positions. The Samgag and Andong soils are associated in residual upland positions.

Drainage and Permeability: Poorly drained. Permeability is very rapid and runoff is ponded or very slow. The ground water table is at or near the surface most of the year except where artificially controlled. Most areas are dyked and terraced for rice paddy, thus flooding is no particular hazard in most broad alluvial plain areas.

Use and Vegetation: Most areas are used for paddy rice.

Distribution and Extent: The Sindab soils are of moderate extent and are distributed along the main rivers and in local valley alluvial plains, mainly in granitic areas throughout the country.

Series Established: Ulju Gun, Gyeongsangnam Do, 1967.

Remarks: The Ap horizon is more brown than normal in the typifying pedon because reddish fine textured soil from the uplands has recently been added to the Ap horizon, according to the farmers custom, to improve the physical conditions and add iron.

Lab. Nos. Fr130-132 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
			Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture								International			
0-12	Ap	17.4	17.0	23.9	27.5	15.8	6.0	7.5	2.3	CoS	71.9	21.6	4.2	CoS
12-40	C1g	13.8	22.3	27.0	25.0	12.8	5.4	5.4	2.1	CoS	77.0	16.5	4.4	CoS
40-80	C2g	11.1	25.5	29.1	30.2	10.1	2.0	1.0	2.1	CoS	87.7	9.4	0.8	CoS

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	Mn ppm	Free Fe_2O_3 %
13.5	9.8	2.9	-	6.3	5.1	0.72	40	10.4	0.16
9.5	7.2	2.1	1.64	5.3	4.2	0.39	26	12.8	0.16
4.4	4.2	1.8	1.65	4.6	3.9	0.10	17	-	-

2/ CEC	Extractable Cations Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations	Elemental Analysis of Clay: Igni. loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %
	me/100g												
2.10	1.80	0.60	0.10	0.13	0.05	127.6	98.2	10.69	2.52	49.59	3.48	29.95	0.89
2.20	1.20	0.60	0.08	0.13	0.19	91.4	91.4	10.82	2.23	46.98	5.56	32.25	1.86
1.50	0.85	0.35	0.08	0.08	0.32	90.7	81.0	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JYH, JFD
17 November, 1969

SINHEUNG SERIES

The Sinheung series is a member of the fine loamy, mixed, mesic, non acid family of Aeric Fluventic Haplaquepts (Low-Humic Gley intergrading to Alluvial soils). These soils have moderately thick grayish brown, dark gray or light olive brown loam or silt loam mottled Ap horizons; moderately deep yellowish brown or strong brown silt loam, loam or fine sandy loam cambic Bg horizons with grayish brown, dark grayish brown or gray mottles. Cg horizons are dark grayish brown or grayish brown loam, silt loam or fine sandy loam with yellowish brown mottles. This series is formed in recent alluvium on broad continental alluvial plains.

Typifying Pedon: Sinheung silt loam - rice paddy (Field description Buyeo Gun profile No. 135; colors are for moist soil.)

Ap -- 0 to 12 cm. Light olive brown (2.5Y 5/4) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; crushed color light olive brown (2.5Y 5/4); puddled, structureless (massive); friable, nonsticky and nonplastic; abrupt smooth boundary; pH 5.0. See Remarks.

A1g -- 12 to 32 cm. Dark gray to gray (5Y 4.5/1) silt loam; few medium distinct strong brown (7.5YR 5/6) mottles; crushed color olive gray (5Y 5/2); weak coarse platy and some blocky structure; friable, slightly sticky and slightly plastic; abrupt smooth boundary; pH 6.0.

B1 -- 32 to 54 cm. Faintly mottled brown (10YR 4/3) and grayish brown (10YR 5/2) silt loam; weak coarse prismatic structure breaking to weak coarse platy prismatic structure breaking to weak coarse platy in upper part; few medium distinct yellowish brown (10YR 5/6) inprism and thin gray (10YR 5/1) exprism mottles; crushed color dark grayish brown to grayish brown (2.5Y 4.5/2); slightly firm, slightly sticky and slightly plastic; few fine discontinuous random inped tubular pores; abrupt smooth boundary; pH 6.5.

B2g -- 54 to 97 cm. Dark grayish brown (10YR 3/2) silty clay loam; common medium distinct inprism yellowish brown (10YR 5/6) mottles; weak to moderate coarse prismatic structure; firm, sticky and plastic; moderately thick discontinuous gray (5Y N5/) exprism cutans; common very fine continuous vertical exped tubular simple pores; abrupt smooth boundary; pH 6.5.

Cg -- 97 to 140 cm. Stratified dark grayish brown (2.5Y 4/2) sandy loam; few medium faint olive brown (2.5Y 4/4) mottles; friable, slightly sticky and slightly plastic; pH 6.5.

Type Location: Buyeo Gun, Chungcheongnam Do, about 70 meters north of Marugol village on the Yanghwa-Seocheon road, Yanghwa Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. Reaction is strongly to slightly acid. Ap or A1 horizons are grayish brown, dark grayish brown, dark gray or light olive brown silt loam, loam, fine sandy loam or very fine sandy loam in paddy. Cambic B horizons have common or many, distinct or prominent mottles of various hues including brown, grayish brown, dark grayish brown, gray or very dark gray. The texture of B horizons is dominantly loam, silt loam, light clay loam, light silty clay loam or heavy fine sandy loam. There is little evidence of clay accumulation. Cg horizons are grayish brown, dark grayish brown or gray weakly stratified silt loam, silty clay loam, or fine sandy loam with olive brown or brown mottles below 60 to 100 cm. Textures commonly are coarser with depth.

Competing Series and Their Differentiae: They include the Yongji, Yeongsan, Hagsan and Manseong soils. The Yongji soils are better drained with at least one horizon in the control section free of gray mottles, and occur in local valley alluvial positions. The Yeongsan soils have coarser textured sandy substrata. The Hagsan soils are better drained and have moderately deep fine loamy textures over sandy C horizons. The Manseong soils have fine loamy over sandy-skeletal textures.

Setting: The Sinheung soils occur on level to nearly level undissected broad continental alluvial plains. Slopes are less than 2 percent.

Principal Associated Soils: They are associated with the Yeongsan, Hagsan, Hwabong, Gangdong, Bonryang, Gyuam, Ihyeon and Hamchang soils. The Hwabong soils are better drained, in the sandy textures family, and occur in levee positions. The Gangdong soils are deep, have fine loamy texture over sandy C horizons and are poorly drained. The Ihyeon and Gyuam soils have brown colors and belong to the coarse silty texture family. The Hamchang soils have grayer colors and are poorly drained.

Drainage and Permeability: Imperfectly drained. Permeability is moderately slow. Runoff is slow. The ground water table fluctuates chiefly between about 30 and 80 cm. except where artificially controlled.

Use and Vegetation: Most areas are used both for non-irrigated barley during the dry winter and spring seasons and flooded rice during wet summer seasons.

Distribution and Extent: The Sinheung soils are of moderate extent and occur on broad alluvial plains along the main continental rivers.

Series Established: Seobong Ri, Songjeong Eup, Gwangsan Gun, Jeollanam Do, March 1967.

Remarks: The typifying pedon No. 135 from Buyeo Gun contains somewhat less clay than is typical for the series. The Ap is more brown than typical probably because reddish fine texture soil from the uplands has recently been added, according to the farmers custom, to improve the physical soil condition and iron content.

Lab. Nos. Cg27-31 Typifying Pedon

Depth cm	Hori- zon	Gra- vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex- tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 12	Ap	1.0	0.6	1.4	6.4	13.3	11.9	51.1	15.3	SiL	10.1	43.0	31.6	CL
12- 32	A1g	0.4	0.9	2.9	9.4	17.3	12.9	44.0	12.4	L	15.7	45.1	26.6	L
32- 54	B1	0.0	1.2	2.5	7.8	18.9	15.7	41.1	12.8	L	14.1	45.1	28.0	L
54- 97	B2g	0.0	0.5	0.8	2.3	3.6	9.2	61.6	22.0	SiL	4.2	34.9	38.9	CL
97-140	Cg	1.2	—	0.4	—	3.5	15.9	64.8	15.4	SiL	0.7	51.3	32.6	CL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
53.5	42.0	12.5	5.3	4.0	1.58	7.65	2.38	0.87	0.15	0.10	1.35	45.8	72.2
42.7	31.5	10.5	5.8	4.5	2.22	6.60	3.25	1.55	0.15	0.08	0.10	76.2	98.1
36.3	26.9	10.0	6.6	5.1	0.63	6.85	3.88	1.85	0.20	0.08	0.05	87.7	99.2
41.7	35.0	15.0	6.9	5.1	1.69	11.40	6.62	3.50	0.22	0.10	0.05	91.6	99.5
25.2	18.3	7.1	6.6	4.7	0.63	5.10	2.75	1.37	0.15	0.05	0.05	84.7	98.9

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
17 November, 1969

SINHYEON SERIES

The Sinhyeon series is a member of the fine loamy, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have thin brown loam A horizons and deep yellowish brown clay loam argillic B horizons. C horizons are multicolored light gray to yellowish brown stratified loamy sand to clay. The Sinhyeon series is developed in very strongly and deeply dissected unconsolidated distinctly stratified old leached fluvio-marine alluvial deposits.

Typifying Pedon: Sinhyeon loam, eroded - forest (Field description Ulju Gun profile No. 98; colors are for moist soil unless otherwise noted.)

A -- 0 to 10 cm. Brown (10YR 5/3), pale brown (10YR 6/3) dry, loam; moderate medium and fine granular structure; friable, slightly sticky and slightly plastic; many medium and coarse living pine tree, azalea and shrub roots; gradual smooth boundary; pH 5.0.

B1 -- 10 to 33 cm. Yellowish brown (10YR 5/4) sandy clay loam; few fine prominent dark red (2.5YR 3/6) mottles; weak medium and coarse subangular blocky structure; friable, slightly sticky and slightly plastic; common fine and medium continuous random inped simple tubular pores; common medium and coarse roots as above; few round hard pebbles; gradual smooth boundary; pH 5.0.

B2t -- 33 to 61 cm. Brownish yellow (10YR 6/8) clay loam; common fine prominent dark red (2.5 YR 3/6) mottles; weak and moderate medium to coarse subangular blocky structure; firm, sticky and plastic; thin patchy clayey cutans; few fine and very fine discontinuous random inped simple tubular pores; about 10 percent strongly weathered gravel; common medium and coarse roots as above; abrupt smooth boundary; pH 5.0.

B31 -- 61 to 82 cm. Light yellowish brown (10YR 6/4) silt loam; many medium and coarse faint light yellowish brown mottles; moderate medium subangular blocky structure; firm, slightly sticky and slightly plastic; thin patchy clayey cutans; common fine discontinuous random exped and inped simple tubular pores; about 5 percent round sandstone gravel; few medium and coarse roots as above; abrupt wavy boundary; pH 5.5.

B32 -- 82 to 101 cm. Reddish yellow (7.5YR 6/8) loam; common fine and medium prominent white (10YR 8/2) and few medium and coarse distinct black mottles; crushed color yellowish brown (10YR 5/8); weak moderate and coarse subangular blocky structure breaking to find granular; firm, slightly sticky and slightly plastic; thin patchy clayey cutans; few fine discontinuous random inped simple tubular pores; about 15 percent very strongly weathered feldspar and shale gravel; abrupt smooth boundary; pH 5.0.

C1 -- 101 to 130 cm. Mottled brownish yellow (10YR 6/8) and light gray (2.5Y 7/0) silt loam; crushed color yellow (10YR 7/6); weak medium and coarse platy structure breaking to medium subangular blocky; firm, sticky and plastic; few fine discontinuous random inped simple tubular pores; about 7 percent very strongly weathered sandstone gravel; clear smooth boundary; pH 5.0.

C2 -- 130 to 150 cm. Light gray (2.5Y N7/0) loam; many medium and coarse distinct yellow (10YR 7/8) mottles; structureless (massive); firm, slightly sticky and slightly plastic; few fine discontinuous random simple tubular pores; this horizon may be stratified with sand, gravel, cobbles and sea shells.

Type Location: Ulju Gun, Gyeongsangnam Do, about 300 meters west of Sinhyeon Ri, 100 meters south of Jeongja, Ulsan City road, Gangdong Myeon (Muryong mountain).

Range in Characteristics: Solum thickness ranges from 100 to 125 cm. and depth to hard rock is probably more than 10 meters in most areas. Dissection has reached bedrock is some areas. Base saturation is less than 35 percent in the solum but may be more than 60 percent in some C horizons. Reaction is strongly acid throughout the solum but ranges widely in the C horizons. Few round gravel and cobbles occur. A horizons are 5 to 20 cm., thick, brown or dark brown moist or where eroded pale brown, dark yellowish brown, light brown, brownish yellow or light yellowish brown dry, loam, silt loam or clay loam. Bt horizons are 50 to 100 cm. thick, strong brown, reddish yellow, yellowish brown or brownish yellow clay loam, sandy clay loam or silty clay loam. C horizons are very deep stratified brownish yellow, light gray, yellow, strong brown, yellowish brown or light yellowish brown loam, silt loam, clay loam, sandy clay loam, clay loamy sand or sand.

Competing Series and Their Differentiae: These include the Taehwa, Gongseong, Chundo and Sinjeong soils. The Taehwa soils are formed in residuum and lack very deep stratified C horizons. The Gongseong soils have fine clayey textures and high base status. The Chundo soils have browner colors, fine clayey textures and occur on lower terraces. The Sinjeong soils lack argillic B horizons and are derived from residual tuff conglomerate materials.

Setting: The Sinhyeon soils occur in very deep very strongly dissected strongly stratified unconsolidated fluvio-marine deposits near the sea. Dominant slopes are 15 to 30 percent and the range is from 7 to 100 percent.

Principal Associated Soils: No other associated series have been established on these parent materials because of the small extent. Some of the associated soils on other parent materials are the Jeongja, Cheongog, Sinjeong and Samgag soils. The Jeongja soils are shallow over residual basic rocks. The Cheongog soils have red colors and fine clayey textures. The Samgag soils have coarse loamy textures, lack argillic B horizons and are derived from residual granitic materials.

Drainage and Permeability: The Sinhyeon soils are well drained and are probably moderately or slowly permeable as they erode easily. Runoff is probably rapid.

Use and Vegetation: Most areas grow pine forest but some of the more gently sloping areas are cultivated for upland crops.

Distribution and Extent: The Sinhyeon soils are of small extent and occur along the southeast cost from Pohang to Ulsan.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966.

Lab. Nos. U526-532 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 10	A	3.9	0.8	3.8	8.3	15.0	12.9	35.2	24.0	L	15.9	42.1	18.0	SCL
10- 33	B1	7.0	3.9	12.8	18.5	15.8	6.7	18.4	23.9	SCL	40.4	25.4	10.3	SCL
33- 61	B2t	0.2		5.3		7.2	11.2	44.2	32.1	CL	6.2	34.0	27.7	LiC
61- 82	B31	1.0	1.0	2.5	4.1	8.8	11.2	51.1	21.3	SiL	9.0	40.5	29.2	CL
82-101	B32	3.1	1.0	2.8	4.9	10.5	12.2	49.0	19.6	L	10.5	39.6	30.3	CL
101-130	C1	0.6	0.4	1.4	4.6	13.0	15.0	50.7	14.9	SiL	8.5	51.8	24.8	L
130-150	C2	1.2		1.8	6.6	16.3	14.5	36.2	24.6	L	11.3	42.8	21.3	CL

Moisture Retention %			pH		O.M.	2/ CEC	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H2O (1:1)	1 N KCl	%	me/100g	Ca	Mg	Na	K	H	CEC	Sum of Cations
	23.4	10.3	4.7	3.3	0.30	7.82	0.70	2.20	0.20	0.10	-	41.0	-
	20.0	8.6	4.7	3.4	0.42	7.18	0.40	1.80	0.38	0.10	-	36.0	-
	28.1	14.8	4.6	3.3	0.13	9.72	0.70	2.10	0.20	0.12	-	34.0	-
	23.4	9.1	5.0	3.5	0.13	5.84	0.30	0.70	0.12	0.10	-	21.0	-
	23.6	7.8	5.0	3.7	0.42	5.32	0.50	0.10	0.22	0.10	-	17.0	-
	22.3	9.1	4.7	3.5	0.13	6.42	1.80	1.80	0.24	0.38	-	66.0	-
	25.1	10.6	4.8	3.2	0.13	5.96	0.90	2.50	0.24	0.12	-	63.0	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
Rev. UHT, JFD
1 Sept., 1969

SINJEONG SERIES

The Sinjeong series is a member of the fine loamy, mixed, mesic family of Typic Dystrochrepts (Lithosols). These soils have thin dark brown slightly gravelly loam A horizons and moderately deep strong brown gravelly loam cambic B horizons. C horizons are very deep brownish yellow gravelly silt loam tuff conglomerate saprolite on hilly relief.

Typifying Pedon: Sinjeong loam, eroded - pine forest (Field description Ulju Gun, profile No. 81; colors are for moist soil.)

A -- 0 to 6 cm. Dark yellowish brown (10YR 4/4) slightly gravelly loam; moderate fine to medium granular structure; friable, slightly sticky and slightly plastic; approximately 8 percent round porphyry gravel on the surface. Many fine to coarse pine tree roots; gradual wavy boundary; pH 5.5.

B2 -- 6 to 33 cm. Strong brown (7.5YR 5/6) gravelly loam; weak fine and medium subangular blocky structure; firm, slightly sticky and slightly plastic; many very fine to medium continuous random inped and exped dendritic tubular pores; approximately 20 percent slightly to strongly weathered round porphyry and quartz gravel; common fine to coarse roots as above; clear wavy boundary; pH 5.0.

B3 -- 33 to 53 cm. Mottled strong brown (7.5YR 5/6) and black (N2) gravelly loam; crushed color dark yellowish brown (10YR 3/4); weak fine to coarse blocky structure easily breaking to fine and medium granular; slightly firm, slightly sticky and slightly plastic; many medium and coarse Mn concretions; common pores as above; approximately 15 percent gravel as above; few fine to coarse roots as above; clear smooth boundary; pH 5.0.

C -- 53 to 130 cm. Mottled brownish yellow (10YR 6/6-6/8), gray (N6), yellow (10YR 8/6) and strong brown (7.5YR 5/8) gravelly silt loam; crushed color olive yellow (2.5YR 6/6); structureless (massive); approximately 10 percent strongly weathered round gravel and cobbles; common very fine pores as above; no roots; pH 4.5.

Type Location: Ulsan City, Gyeongsangnam Do, about 500 meters east of Daun Ri.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hardrock is commonly more than 3 meters, ranging from few hard bedrock outcrops to more than 10 meters. Base saturation is less than 35 percent. Reaction is strongly acid throughout the profile. 5 to 20 percent gravel occurs throughout the profiles. A horizons, 5 to 15 cm. thick, are brown or dark brown loam or silt loam with or without few round gravel pieces. Where eroded, A horizons may be dark yellowish brown silty clay loam. Cambic B horizons are strong brown, yellowish brown, reddish yellow or yellowish red gravelly silt loam, loam or silty clay loam. C horizons are variably colored brownish yellow, gray, yellow, strong brown and yellowish red gravelly silt loam, loam, sandy loam or silty clay loam deeply weathered porphyry tuff or tuff conglomerate saprolite.

Competing Series and Their Differentiae: These include the Yuha, Sinhyeon, and Taehwa series. The Yuha soils have fine silty family textures and lack cambic B horizons. The Sinhyeon soils are high in base saturation, have argillic B horizons and are developed in unconsolidated dissected marine deposits. The Taehwa soils have somewhat paler colors, argillic B horizons, thinner saprolite and andesite porphyry parent materials.

Setting: The Sinjeong soils occur on rolling to steep, strongly dissected hilly and low mountainous areas underlaid by tuff conglomerate saprolite mainly 5 to 10 meters thick over consolidated hard rock. Slopes are dominantly 15 to 30 percent, but range from 7 to 60 percent.

Principal Associated Soils: The Jeongja, Mudeung, Daegu, Samgag and Jisan soils are associated with the Sinjeong soils on different parent materials. The Mudeung soils have sola less than 50 cm. thick over hard andesite porphyry parent materials. The Daegu soils have sola less than 50 cm. thick, high base saturation and are formed from gray shale parent materials. The Samgag soils have coarse loamy textures and occur in associated granitic areas. The Jisan soils are formed in local valley alluvium.

Drainage and Permeability: Well drained. Permeability is probably moderate, and runoff is moderately rapid or rapid depending on the slope.

Use and Vegetation: Most areas of these soils are used for pine forest, though some are cultivated for soybean, potato, sweet potato and similar crops.

Distribution and Extent: The Sinjeong soils are of rather small extent and are distributed in hilly and mountainous areas of the country with the tuff conglomerate geologic materials.

Series Established: Ulju Gun, Gyeongsangnam Do, 1966.

Lab. Nos. U462-465 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
0- 6	A	8.3	3.3	6.4	8.3	12.5	9.5	34.9	25.1	L	20.7	30.5	23.7	LiC
6- 33	B2	18.9	3.0	5.8	7.6	10.4	7.7	41.3	24.2	L	18.8	29.8	27.2	CL
33- 53	B3	18.0	6.1	12.9	8.6	8.9	7.8	36.4	19.2	L	29.4	24.0	27.3	CL
53-130	C	7.8	3.5		9.8	11.9	6.8	51.8	16.2	SiL	16.7	27.8	39.3	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	pH 1 N KCl	O.M. %	CEC 2/	Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
						me/100g							
	22.1	11.0	5.1	3.6	1.67	8.00	0.77	1.00	0.08	0.25	-	26.3	-
	22.4	11.5	5.0	3.6	1.55	7.50	0.65	0.87	0.08	0.15	-	23.3	-
	25.0	10.1	5.2	3.5	0.18	8.50	0.87	2.12	0.12	0.10	-	37.8	-
	28.0	9.2	5.3	3.4	0.25	8.30	1.62	2.00	0.23	0.08	-	35.3	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

SIRYE SERIES

The Sirye series is a member of the fine clayey, mixed, mesic family of Typic Hapludalfs (Red-Yellow Podzolic soils with high base status). These soils have thin brown to dark brown silt loam A horizons and moderately deep yellowish red clay loam to clay Bt horizons. They occur on rolling topography in areas of grayish brown shale and fine textured sandstone.

Typifying Pedon: Sirye silt loam - pine forest (Field description Dalseong Gun profile No. 109; colors are for moist soil.)

A -- 0 to 15 cm. Brown to dark brown (7.5YR 4/4) loam; moderate fine and medium granular structure; friable, slightly sticky and slightly plastic; common fine pores; many fine grass roots; approximately 5 percent weathered shale gravel; clear smooth boundary.

B1 -- 15 to 40 cm. Yellowish red (5YR 5/8) light clay loam; moderate fine and medium subangular blocky structure; friable, sticky and plastic; few fine pores; few fine and medium roots; approximately 10 percent weathered shale gravel; clear wavy boundary.

B2t -- 40 to 60 cm. Yellowish red (5YR 5/8) clay loam; moderate fine and medium prismatic structure breaking to moderate medium subangular blocky; firm, sticky and plastic; thick continuous clay cutans on prisms and thin continuous on blocky aggregates; few fine distinct reddish brown (5YR 4/4) mottles and very few fine Mn concretions; few fine pores; no roots; very few weathered shale fragments; clear wavy boundary.

B3t -- 60 to 80 cm. Yellowish brown (10YR 6/8) clay loam; many medium distinct and prominent light reddish brown (5YR 6/3) and red (2.5YR 5/8) mottles; crushed color reddish yellow (7.5YR 6/6); moderate medium prismatic structure breaking to moderate and strong medium and coarse subangular blocky; firm, sticky and plastic; thick discontinuous brownish yellow (10YR 6/6) clayey cutans; approximately 10 percent strongly weathered shale gravel; gradual wavy boundary.

C -- 80 to 100 cm. Yellowish brown (10YR 6/6) gravelly clay loam; as above with massive to coarse blocky structure overlying hard grayish brown shale.

Type Location: Daegu City, Gyeongsangbug Do, approximately 300 meters northwest Seongdang Lake on hillside opposite Himang Orphanage.

Range in Characteristics: The solum thickness ranges from 50 to 100 cm. Depth to bedrock is generally between 100 and 150 cm. Base saturation is more than 60 percent in the control section. Reaction is strongly to medium acid. A1 or Ap horizons, ranging up to 20 cm. thick depending on the degree of erosion, are mostly brown to dark brown when moist, or yellowish brown to light yellowish brown when dry, silt loam or loam. Silty clay loam textures may occur where eroded. Bt horizons are dominantly yellowish red or red heavy silty clay loam, clay loam, silty clay or clay. C horizons are rather thin light brown, reddish yellow, yellowish brown or strong brown gravelly silt loam, silty clay loam or clay loam mixed with varying amounts of slightly to strongly weathered shale gravel materials. Little or no mica occurs in these soils.

Competing Series and Their Differentiae: These are the Dalcheon, Jeonnam, Bonggye, Buyeo, Cheonggog, Bancheon and Pyeongchang soils. The Dalcheon soils have friable deeply weathered brownish yellow or light yellowish brown granitic saprolite and contain mica throughout. The Jeonnam soils have deep Bt horizons and are developed in micaceous residuum derived from acidic crystalline materials. The Bonggye soilshave deep Bt horizons, thick C horizons, are mica free and are developed from porphyritic rocks. The Buyeo soils have fine loamy textures and are derived from reddish brown sandstone and shale parent materials. The Cheongog soils have redder colors, contain somewhat more clay and are derived from dark colored basic crystalline materials. The Bancheon soils are deep and are developed in stratified old alluvial materials. The Pyeongchang soils have very fine clayey textures and are derived from limestone parent materials.

Setting: The Sirye series is on gently sloping, sloping and hilly relief and is derived from grayish brown shale and fine grained sandstone materials. The slopes range from 2 to 30 percent but dominant slopes are 2 to 7 percent.

Principal Associated Soils: The Daegu soils occur at higher elevations and on steeper side slopes. The Banho and Yuga soils are associated in local valley alluvial-colluvial and alluvial plain positions. The Bancheon and Hwadong soils occur on dissected river terraces.

Drainage and Permeability: Well drained. Permeability is slow. Runoff is moderate or rapid according to the slope.

Use and Vegetation: Most areas of this series are used for cultivated crops, such as barley, wheat, millet, Indian millet, corn, buckwheat, red pepper, sorghum and sweet potato. Some areas grow pine forest.

Distribution and Extent: The Sirye soils are of small extent and occur in the grayish brown shale areas located in the south central and southeastern parts of the country.

Series Established: Ulju Gun, Gyeongsangnam Do, July 1966.

Remarks: The argillic B horizon normally is somewhat higher in the profile than in the typifying pedon.

Lab. Nos. T317-320 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0-15	A	9.4	5.1	6.2	4.7	4.6	3.3	56.2	19.9	SiL	17.3	21.5	41.3	CL
15-40	B1	16.8	4.3	4.7	5.0	6.3	4.8	52.3	22.6	SiL	15.6	21.3	40.5	CL
40-60	B2t	3.4	2.0	2.9	3.1	4.1	3.2	50.7	34.0	SiCL	8.9	6.1	41.0	LiC
60-80	B3t	14.9	2.7	3.8	5.6	5.9	3.7	42.9	35.4	CL	13.7	16.5	34.4	LiC

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH H2O (1:1)	pH 1 N KCl	O.M. %	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	29.0	9.1	5.4	4.0	1.90	6.80	2.20	2.00	0.20	0.20	-	68.0	-
	27.0	9.0	4.9	3.2	0.76	6.36	0.70	1.10	0.46	0.14	-	38.0	-
	29.8	25.1	5.0	3.2	0.50	10.44	2.10	3.20	0.32	0.14	-	55.0	-
	29.0	15.7	5.0	3.2	0.95	13.10	4.00	4.40	0.38	0.14	-	68.0	-

Elemental Analysis of Clay: H_2O %	Igni. Loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %	3/ CEC me/100g
2.57	7.60	3.05	53.79	10.75	23.07	3.01	-
4.04	7.40	3.48	57.76	6.46	24.03	2.61	27.02
3.00	8.07	2.97	54.22	7.72	26.06	1.94	-
4.71	8.60	2.84	53.12	7.12	27.18	2.30	43.79

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

3/ Versene Method, 1 N $CaCl_2$ Saturated, NaCl Extracted

Established Series
UKT, JFD
15 October, 1969

SONGJEONG SERIES

The Songjeong series is a member of the fine loamy, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have thin brown to dark brown loam Ap or A horizons and weakly expressed moderately deep yellowish red clay loam Bt horizons. The C horizons are very deep yellowish red fine sandy loam or silt loam granite saprolite. They are developed mainly in hilly areas.

Typifying Pedon: Songjeong loam - wild grass (Field description Gimhae Gun profile No. 136; colors are for moist soil.)

A -- 0 to 9 cm. Brown to dark brown (7.5YR 4/4) loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; many fine grass roots; abrupt smooth boundary; pH 5.0.

B1t -- 9 to 24 cm. Yellowish red (5YR 5/8) clay loam; weak fine to medium subangular blocky structure; friable, slightly sticky and slightly plastic; common fine mica; few fine grass roots; clear smooth boundary; pH 4.8.

B2t -- 24 to 47 cm. Red (2.5YR 5/6) clay loam; weak fine and medium subangular blocky structure; thin patchy clay cutans; friable, sticky and plastic; mica as above; few fine grass roots; gradual wavy boundary; pH 5.0.

B3 -- 47 to 77 cm. Yellowish red (5YR 5/8) sandy clay loam; weak coarse to medium subangular blocky structure; friable, slightly sticky and slightly plastic; mica as above; clear smooth boundary; pH 5.0.

C -- 77 to 110 cm. Strong brown (7.5YR 5/8) sandy loam; granite saprolite; firm, nonsticky and nonplastic; pH 5.0.

Type Location: Gimhae Gun, Gyeongsangnam Do, about 500 meters east of Daegan Primary School, Daegan Ri, Daedong Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. Depth to hard rock is more than 3 meters and ranges to more than 10 meters. Base saturation is less than 35 percent. Common fine and medium white and yellow mica are throughout the profiles. Reaction is very strongly to strongly acid. Clay content ranges from 18 to 35 percent in the solum. A horizons are 10 to 20 cm. thick, brown to dark brown loam, silt loam or fine sandy loam. Where eroded they may be less than 10 cm. thick, yellowish red or reddish brown clay loam or silty clay loam. Dry A horizons may be brown, light brown or pale brown with 7.5YR or 10YR hues. Bt horizons are yellowish red, reddish brown, reddish yellow or red clay loam, loam, silt loam or silty clay loam. Bt horizons structure is mainly weakly expressed and clay cutans are generally thin and discontinuous. C horizons are red, yellowish red or strong brown loam, silt loam or very fine sandy loam very deep and extremely weathered granitic saprolite. Boulders or bedrock outcrops seldom occur.

Competing Series and Their Differentiae: The Gwangsan, Jeonnam, Dalcheon and Jingog series have fine clayey family textures and more distinct structure than Songjeong soils. The Taehwa soils have yellowish brown Bt horizons, lack mica and are derived from andesite porphyry materials. The Chahang soils have very dark brown A horizons. The Mangsil soils have very dark brown stony A horizons and yellowish brown stony Bt horizons.

Setting: The Songjeong soils are on undulating to rolling moderately dissected to destroyed old bedrock pediplanes and hilly uplands underlaid by very deeply weathered granitic rocks. Slopes are dominantly 15 to 30 percent and range from 7 to 60 percent.

Principal Associated Soils: The well drained Seongsan and Baegsan soils are associated with Songjeong soils in local valley alluvial and footslope positions. The Samgag and Dalcheon soils are associated on similar and steeper slopes. The Gwangsan, Jeonnam, Jingog and Gwangju soils are generally associated on the less dissected remnants of old pediplanes.

Drainage and Permeability: Well drained. Permeability is probably moderate and runoff is medium to rapid.

Use and Vegetation: Most gently sloping areas are cultivated for barley, soybean, red pepper, potato, cabbage, radish, sweet potato and similar crops. Most hilly and some rolling areas grow pine forest, shrubs, wild grasses and some mixed forest.

Distribution and Extent: The Songjeong soils are of relatively large extent and are distributed in the rolling, hilly and low mountainous areas with granitic geology throughout the country.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Lab. Nos. G1271-274 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05 <.002	Clay .002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 9	A	3.7	7.1	11.7	16.7	10.6	8.5	27.3	18.1	L	37.8	24.6	19.5	SCL
9-24	B1t	0.8	3.3	9.1	15.0	6.2	11.5	29.8	25.1	L	29.5	24.0	21.4	LiC
24-47	B2t	0.0	2.1	6.4	12.9	10.9	8.6	28.0	31.1	CL	23.3	26.4	19.2	LiC
47-77	B3	7.8	10.5	14.9	23.0	14.6	6.3	10.4	20.3	SCL	51.0	23.5	5.2	SCL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
31.4	24.5	12.8	4.8	3.8	4.03	7.20	1.22	0.70	0.17	0.40	-	34.6	-
31.2	24.5	13.5	4.8	3.7	1.03	7.65	0.62	0.62	0.25	0.45	-	35.4	-
36.6	28.3	16.4	4.9	3.6	0.21	8.80	0.42	0.52	0.15	0.55	-	18.6	-
23.6	18.1	11.3	5.1	3.8	0.10	4.80	0.30	0.17	0.10	0.27	-	17.5	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
12 November, 1969

SUBUG SERIES

The Subug series is a member of the coarse loamy over sandy skeletal, mixed, mesic family of Fluventic Haplaquents (Low-Humic Gley-Alluvial soils). These soils have moderately thick dark grayish brown fine gravelly sandy loam Apg horizons. The Cg horizons are gray very gravelly sandy loam or loamy sand with few or no mottles. They are developed in gravelly alluvial materials in gently sloping to sloping local valley alluvial plains and alluvial fans.

Typifying Pedon: Subug sandy loam - rice paddy (Field description Gwangsan Gun profile No. 142; colors are for moist soil.)

Ap1g -- 0 to 16 cm. Dark grayish brown (10YR 4/2) gravelly sandy loam; few fine faint dark yellowish brown (10YR 4/4) mottles; puddled structure cracking when drained to weak coarse prismatic and breaking to weak coarse granular; friable, slightly sticky and slightly plastic; about 20 percent unweathered fine granite gravel; common fine whitish mica; common fine rice roots; abrupt smooth boundary.

Ap2g -- 16 to 39 cm. Very dark grayish brown (2.5Y 3/2) gravelly sandy loam; common fine prominent dark yellowish brown (10YR 4/4) mottles; weak coarse prismatic breaking to weak coarse platy and coarse blocky; friable, slightly sticky and slightly plastic; common fine continuous vertical pores; about 30 percent gravel as above; mica as above; few fine rice roots; abrupt smooth boundary.

C1g -- 39 to 56 cm. Gray to olive gray (5Y 5/1.5) very gravelly loamy coarse sand; common fine prominent dark yellowish brown (10YR 3/4) mottles; structureless, single grain; loose, nonsticky and nonplastic; about 50 percent fine and medium gravel and cobble as above; mica as above; abrupt smooth boundary.

C2g -- 56 to 100 cm. Dark gray (5Y 5/1) very gravelly to cobbly sand; common fine distinct olive brown (2.5Y 4/4) mottles; structureless, single grain; loose, nonsticky and nonplastic; mica as above.

Type Location: Gwangsan Gun, Jeollanam Do, about 100 meters south of Gwangsan Ri, Imgog Myeon.

Range in Characteristics: Depth to bedrock is probably 3 meters or more. Base saturation is more than 60 percent. Reaction is medium acid in the Ag horizons and extremely to medium acid in the Cg horizons. The Apg or A1g horizons are 15 to 30 cm. thick, grayish brown, gray, dark gray, dark grayish brown or olive gray fine gravelly sandy loam, loam or silt loam with dark yellowish brown, strong brown, yellowish red or reddish brown mottles and 5 to 35 percent gravel. Farmers generally remove most large gravel from the A horizons especially when used for rice paddy. Cg horizons are dark gray, gray, olive gray, grayish brown or dark grayish brown stratified very gravelly sand, loamy coarse sand or sandy loam with few dark yellowish brown, olive brown, strong brown or no mottles and 35 to 90 percent gravel.

Competing Series and Their Differentiae: Similar soils are the Seoggye, Sachon, Hamchang, Gangdong, Manseong and Tongcheon series. The Seoggye soils have coarse loamy textures, more mottles and imperfect drainage. The Sachon soils have browner colors, imperfect drainage, contain less gravel and have sandy substrata. The Hamchang soils have coarse loamy textures throughout. The Gangdong soils have fine loamy over sandy textures. The Manseong soils have browner colors, imperfect drainage and fine loamy over sandy skeletal textures. The Tongcheon soils have less gray mottles, loamy skeletal textures and moderate drainage.

Setting: The Subug soils occur in alluvial materials on gently sloping local valley alluvial plains and fans. Dominant slopes are 2 to 7 percent and the range is from 0 to 30 percent. The water table is in or near the surface except where artificially controlled.

Principal Associated Soils: These are the Hogye, Hwangryong, Tongcheon, Samgag, Manseong, Sachon and Gangdong soils. The Hogye soils have dark brown A horizons, loamy skeletal textures, are well drained and occur mainly in alluvial fan positions above the Subug soils. The Hwangryong soils are well drained, have sandy skeletal textures and occur on alluvial plains adjacent to cobbly river wash. The Tongcheon soils occur on alluvial plains in mountain valleys. The Samgag soils occur in residual upland positions. The Manseong soils occur in alluvial plain and fan terrace positions. The Sachon soils occur in similar positions. The Gangdong soils occur mostly in broad alluvial plains but some areas are in local valleys.

Drainage and Permeability: Poorly drained. Permeability is moderately rapid and runoff is slow as all areas are level terraced for rice paddy land use.

Use and Vegetation: Most areas are used for paddy rice, and where artificial drainage is adequate barley or wheat is sometimes grown during the dry winter and spring seasons.

Distribution and Extent: These soils are of small extent and are distributed mostly in the southern part of country in granitic areas.

Series Established: Gwangsan Gun, Jeollabug Do, 1966.

Remarks: The typifying pedon appears to have 16 cm. of more or less recent soil accumulation on the surface. The drainage of this series was considered as imperfect before placement in the new classification system because double crops can be grown.

Lab. Nos. K421-423 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
			Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture								International			
0-16	Ap1g	17.3	7.4	16.7	17.8	16.7	7.9	23.3	10.2	SL	47.3	26.2	16.3	CoSL
16-39	Ap2g	28.7	7.0	14.9	15.0	14.9	6.6	30.3	11.3	SL	42.7	25.4	20.6	SL
39-56	C1g	46.7	17.8	23.3	15.4	12.4	7.1	18.9	5.1	LCoS	59.9	24.3	10.7	CoSL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	CEC 2/	Ca	Mg	Na	K	H	Base Sat. % CEC	Sum of Cations
							me/100g	Extractable Cations						
	24.0	11.5	5.1	4.4	2.56	83	4.80	4.90	0.80	0.06	0.05	0.29	121.0	95.2
	21.2	8.9	5.8	4.8	3.07	9	6.90	5.80	0.60	0.16	6.09	0.05	99.8	99.2
	13.5	4.7	3.5	3.0	1.23	5	4.30	3.65	0.85	0.05	0.05	3.97	106.9	53.7

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

SUGYE SERIES

The Sugye series is a member of the fine silty, mixed, acid,mesic family of Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick brown or dark gray silty clay loam Apg horizons with mottles and moderately deep dark gray silty clay loam Bg horizons with less mottles. The Cg horizons are dark gray silty clay loam with few or no mottles. They are formed in mixed alluvium on broad continental alluvial plains.

Typifying Pedon: Sugye silty clay loam - rice paddy (Field description Gwangsan Gun profile No. 131; colors are for moist soil.)

Ap1g -- 0 to 10 cm. Light olive brown (2.5Y 5/4) silty clay loam; many fine to medium prominent reddish brown (5YR 4/4) and common medium faint dark gray (5Y 4/1) mottles; crushed color olive (5Y 5/4); puddled structure, cracking when drained to moderate very coarse prismatic which breaks to weak coarse blocky; friable, very sticky and very plastic; many fine to medium rice roots; few fine mica flakes; few fine continuous pores; abrupt smooth boundary.

Ap2g -- 10 to 29 cm. Dark gray (5Y 4/1) silty clay loam; common fine to medium prominent yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure breaking to weak coarse platy; firm, very sticky and very plastic; common fine continuous tubular pores; common fine rice roots; few fine mica flakes; clear smooth boundary.

Bg -- 29 to 51 cm. Dark gray (5Y 4/1) silty clay loam; common fine prominent reddish yellow (5YR 6/8) and brown (7.5YR 5/4) mottles; crushed color grayish brown (10YR 4/2); weak very coarse prismatic structure; very sticky and very plastic; common fine continuous vertical pores; few fine rice roots; abrupt smooth boundary.

C1g -- 51 to 65 cm. Dark gray (5Y 4/1) silty clay loam; few fine distinct grayish brown (2.5Y 5/2) mottles; structureless (massive); very sticky and very plastic; few very fine rice roots; abrupt smooth boundary.

C2g -- 65 to 120 cm. Dark gray (5Y 4/1) silty clay loam; structureless (massive); very sticky and very plastic; few fine continuous vertical pores; few very fine rice roots.

Type Location: Gwangsan Gun, Jeollanam Do, 100 meters south of Jangan Ri, Songjeong Eub.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is probably more than 5 meters. Base saturation varies considerably. Reaction is chiefly strongly acid throughout the solum ranging to medium acid in the Cg horizons. The Apg horizons are gray, grayish brown, dark grayish brown, light olive brown or olive brown, silty clay loam, silt loam or loam with mottles. Cambic Bg horizons are gray, dark gray, olive gray, grayish brown or dark grayish brown silty clay loam, silt loam or loam with few yellowish brown, brown, strong brown or reddish yellow mottles. Cg horizons are strongly gleyed dark gray, gray or bluish gray silty clay loam, silt loam or loam with few or no mottles.

Competing Series and Their Differentiae: The Subug, Hyocheon, Honam, Bongrim,Hagseong and Hamchang soils are similar. The Subug soils have coarse loamy over sandy skeletal textures. The Hyocheon soils contain $FeCO_3$ mottles in the lower horizons and have fine loamy textures. The Honam soils have fine clayey textures. The Bongrim soils have grayer colors, very poor drainage and change to extremely acid reaction on drying. The Hagseong soils have coarse silty over sandy textures and occur on fluvio-marine plains. The Hamchang soils have coarse loamy textures.

Setting: The Sugye soils occur on level broad continental alluvial plains and are derived from weakly stratified alluvial materials. Dominant slopes are about 0.5 percent and range from 0 to 2 percent.

Principal Associated Soils: These include the Gangdong, Geugrag, Honam and Hyocheon soils in similar physiographic positions. The Gangdong soils have coarse loamy over sandy textures. The Geugrag soils have more yellow mottles, imperfect drainage and fine clayey textures. The Honam soils occur on low terraces. The Hyocheon soils occur in narrow and medium width valley alluvial plains.

Drainage and Permeability: Poorly drained. Permeability is slow and runoff is very slow owing to low lying physiographic positions and level terracing for rice paddy land use.

Use and Vegetation: Most areas are used for paddy rice.

Distribution and Extent: The Sugye soils are of moderate extent and occur chiefly in the southwestern part of the country inland from the fluvio-marine plains, in association with red upland soils.

Remarks: The base saturation and reaction are somewhat lower than is considered characteristic for the series.

Lab. Nos K362-366 Typifying Pedon

Depth cm	Hori- zon	Gra- vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex- tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 10	Ap1g	0.0	0.5	0.8	1.1	1.8	2.8	58.2	34.8	SiCL	2.7	17.3	45.2	SiC
10- 29	Ap2g	0.0	0.4	1.2	1.6	1.9	3.0	57.1	34.1	SiCL	3.4	18.5	44.0	LiC
29- 51	Bg	0.0	—	1.8	—	1.2	2.8	60.4	33.8	SiCL	2.1	17.7	46.4	SiC
51- 65	C1g	0.0	—	1.0	—	2.8	5.1	57.4	33.7	SiCL	1.3	19.7	45.3	SiC
65-120	C2g	0.0	—	0.2	—	0.4	1.1	61.9	36.4	SiCL	0.3	17.9	45.4	SiC

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	45.4	25.5	4.9	3.7	2.30	14.50	5.60	2.90	0.34	0.16	-	62.1	-
	39.1	19.2	5.0	3.9	1.52	13.22	5.80	3.50	0.40	0.14	-	74.2	-
	36.3	15.6	4.9	3.7	2.43	10.62	3.10	2.70	0.30	0.12	-	58.4	-
	45.6	14.8	4.6	3.3	1.62	10.22	1.90	1.30	0.28	0.12	-	35.3	-
	40.3	15.6	4.3	3.1	1.17	10.22	2.10	0.40	0.28	0.12	-	29.0	-

Elemental Analysis of Clay: H_2O %	Igni. loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %
3.33	10.14	2.06	45.20	8.81	31.61	2.47
3.36	10.77	2.19	45.84	8.14	29.98	2.56
-	-	-	-	-	-	-
-	-	-	-	-	-	-
3.94	10.80	2.44	47.61	5.86	29.40	2.02

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
22 Sept., 1969

TAEHWA SERIES

The Taehwa series is a member of the fine-loamy, mixed, mesic family of Typic Hapludults (Red-Yellow Podzolic soils). These soils have thin brown to dark brown gravelly silt loam A horizons and moderately deep yellowish brown to strong brown gravelly silt loam argillic B horizons. C horizons are pale brown loam porphyry saprolite. They are developed in hilly to mountainous areas.

Typifying Pedon: Taehwa gravelly silt loam - forest (Field description Ulju Gun profile No. 15; colors are for moist soil.)

A1 -- 0 to 5 cm. Brown to dark brown (10YR 4/3) gravelly silt loam; moderate very fine and fine granular structure; friable, slightly sticky and slightly plastic; approximately 10 percent slightly weathered angular porphyry gravel; many fine medium living wild grass, azalea and pine tree roots; abrupt smooth boundary; pH 5.5.

A3 -- 5 to 16 cm. Yellowish brown (10YR 4/5) friable gravelly silt loam; weak fine and medium subangular blocky and moderate fine and medium granular structure; friable, slightly sticky and slightly plastic; few fine discontinuous random simple inped tubular pores; approximately 20 percent gravel as above; roots as above; clear wavy boundary; pH 5.5.

B1 -- 16 to 28 cm. Yellowish brown (10YR 5/4) gravelly silt loam; weak medium and fine platy structure in place; mostly moderate medium subangular blocky in hand; friable, slightly sticky and slightly plastic; common roots as above; pores as above; approximately 30 percent gravel as above; pH 5.0.

B21t -- 28 to 47 cm. Strong brown (7.5YR 5/8) slightly gravelly silt loam; moderate fine and medium subangular blocky structure; friable, sticky and plastic; common pores as above; patchy thin clay cutans; approximately 10 percent gravel as above; roots as above; clear wavy boundary; pH 5.0.

B22t -- 47 to 56 cm. Strong brown (7.5YR 5/8) gravelly silt loam; moderate coarse subangular blocky structure; firm, sticky and plastic; common fine pores as above; continuous thin strong brown (7.5YR 5/8) clayey cutans; crushed color reddish yellow (7.5YR 6/8); approximately 30 percent strongly weathered gravel and stone as above; few fine living roots as above; clear wavy boundary; pH 5.0.

B3t -- 56 to 87 cm. Distinctly mottled strong brown (7.5YR 5/8) and brownish yellow (10YR 6/6) loam; weak coarse blocky; common yellowish red (5YR 5/6) clay cutans; crushed color reddish yellow (7.5YR 6/8); few medium horizontal simple tubular pores along structure faces; few fine living plant roots; gradual wavy boundary; pH 5.0.

C -- 87 to 168 cm. Distinctly mottled brownish yellow (10YR 6/8), very pale brown (10YR 8/3) and strong brown (7.5YR 5/6) loam; structureless (massive); weathered residual porphyry with rock structure; crushed color reddish yellow (7.5YR 6/6); few living pine tree roots; pH 5.0.

Type Location: Ulsan City, Gyeongsangnam Do, about 4 km. west of Ulsan City, Taehwa 2 Ri.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and averages about 75 cm. Depth to hard rock is about 2 to 3 meters. Base saturation is less than 35 percent. Reaction is medium acid. 5 to 35 percent weathered gravel and some stones occur throughout the profiles generally with concentrations in the A and upper B horizons. Clay content ranges from 18 to 35 percent in the control section. A horizons are 5 to 20 cm. thick and are brown to dark brown, but where eroded yellowish brown or dark yellowish brown gravelly silt loam, loam or very fine sandy loam. Bt horizons are 50 to 100 cm. thick and are yellowish brown, strong brown, yellowish red or reddish yellow gravelly silt loam, clay loam, light silty clay loam or heavy sandy clay loam with weak or moderate structure. C horizons are 50 to 200 cm. thick, distinctly mottled brownish yellow, very pale brown, strong brown or yellowish brown weathered angular gravelly fine sandy loam, loam or silt loam moderately weathered andesite porphyry saprolite with wavy boundary over hard rock.

Competing Series and Their Differentiae: These are the Bonggye, Mudeung, Ulsan and Songjeong soils. The Bonggye soils have red colors and fine clayey textures. The Mudeung soils have fine-loamy textures and are shallow over hard bedrock. The Ulsan soils have coarse-loamy textures and moderately deep cambic B horizons. The Songjeong soils have very deep saprolite, yellowish red colors and granitic parent materials.

Setting: The Taehwa soils are in hilly to mountainous areas. Slopes are dominantly 15 to 60 percent and range from 7 to 75 percent.

Principal Associated Soils: The shallow Mudeung soils are associated on steeper slopes. The Bonggye soils are associated on more gentle relief generally on associated ridge tops.

Drainage and Permeability: Well drained. Permeability is moderate and runoff is medium to rapid depending on the slope.

Use and Vegetation: Most of the Taehwa soils have a poor growth of pine forest vegetation. A very small extent is used for barley, soybean, red pepper, sweet potato, buck wheat and similar crops.

Distribution and Extent: The Taehwa soils are of moderate extent in the southern part of the country in areas of andesite porphyry.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Remarks: This typifying pedon is slightly eroded.

Lab. Nos. U114-120 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 5	A1	14.6	3.5	4.3	2.3	3.3	2.8	74.7	9.1	SiL	10.7	19.9	60.3	SiL
5- 16	A3	21.7	3.5	5.3	2.9	3.6	3.5	73.1	8.1	SiL	12.4	20.1	59.4	SiL
16- 28	B1	28.5	1.6	3.6	3.0	5.0	4.4	72.2	10.3	SiL	8.9	23.3	57.5	SiL
28- 47	B21t	5.8	0.2	0.9	1.4	7.6	5.3	63.9	20.7	SiL	3.2	24.0	52.1	SiCL
47- 56	B22t	5.3	0.5	0.8	1.5	10.7	7.1	56.8	22.6	SiL	4.0	30.0	43.4	CL
56- 87	B3t	0.2		1.5		20.1	14.9	41.4	22.1	L	3.1	45.4	29.4	CL
87-168	C	0.1		2.0		26.0	14.7	43.6	13.7	L	6.4	50.3	29.6	L

Moisture Retention % 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	S.G	Atterberg Limits % LL	PI	pH H_2O (1:1)	pH 1 N KCl	O.M. %	Avail. P_2O_5 ppm	2/ CEC	Extractable Ca (me/100g)	Mg	Na
	28.3	9.5	-	2.67	-	NP	5.3	3.7	2.60	6	7.7	1.15	0.90	0.80
	25.8	9.1	1.44	2.71	-	NP	5.3	3.5	1.10	0	6.7	0.40	0.55	0.03
	25.8	8.7	-	2.74	29.2	9.3	5.0	3.5	0.80	0	7.2	0.35	0.55	0.12
	28.5	13.5	1.30	2.75	33.6	13.1	5.1	3.5	0.40	-	6.9	0.45	0.80	0.08
	28.2	14.9	-	2.72	37.6	15.3	5.0	3.4	0.30	-	4.9	0.35	0.90	0.06
	29.2	15.0	1.29	2.70	32.1	3.7	5.2	3.5	0.30	-	8.5	0.40	0.80	0.18
	30.2	14.6	-	2.70	-	NP	5.0	3.5	0.20	-	10.3	0.55	1.15	0.14

Cations K	H	Base Saturation % CEC	Sum of Cations	Elemental Analysis of Clay SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %
0.21	-	30.4	-	2.536	55.37	8.73	31.49
0.13	-	16.6	-	2.531	54.36	8.73	30.89
0.10	-	15.6	-.	2.501	55.88	8.14	32.73
0.08	-	20.4	-	2.205	52.56	9.13	34.58
0.18	-	29.4	-	2.007	52.11	10.11	37.60
0.19	-	17.3	-	-	-	-	-
0.14	-	19.2	-	2.093	52.93	6.90	35.70

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, ODH, JFD
12 November, 1969

TOGYE SERIES

The Togye series is a member of the mixed, mesic, family of Typic Udipsamments (Alluvial soils). These soils have thin brown to dark brown gravelly sandy loam to gravelly loamy coarse sand A horizons and strong brown, brown or yellowish brown gravelly sand C horizons. They occur in alluvial fan positions above the flood plains.

Typifying Pedon: Togye loamy coarse sand - tobacco (Field description Buyeo Gun profile No. 199; colors are for moist soil.)

Ap -- 0 to 9 cm. Brown to dark brown (7.5YR 4/4) fine gravelly sandy loam; weak fine and medium granular structure; friable, nonsticky and nonplastic; approximately 10 percent angular quartz and granite gravel; many fine and medium roots; clear smooth boundary.

C -- 9 to 100 cm. Strong brown (7.5YR 5/6) fine gravelly loamy sand; structureless (single grain); nearly loose, nonsticky and nonplastic; few fine roots; many fine mica flakes.

Type Location: Buyeo Gun, Chungcheongbug Do, 1 km. east of gold mine; Imcheon Myeon.

Range in Characteristics: Soil depth is in excess of 150 cm. and ranges to approximately 3 meters over weathered residuum. Fine mica flakes are common to many. Reaction ranges from strongly to medium acid unless limed. Base saturation is commonly more than 50 percent. A horizons 10 to 20 cm. thick, range from brown to dark brown, yellowish brown or dark grayish brown sandy loam, loamy sand, loamy coarse sand or sand with 10 to 35 percent fine gravel and some cobbles. C horizons range from brown, strong brown or yellowish brown gravelly loamy medium sand to gravelly loamy coarse sand. Control section textures are more heterogeneous than in similar alluvial plain soils.

Competing Series and Their Differentiae: These are the Bonryang, Hwabong, Seongsan, Nagdong and Ibseog series. The Bonryang soils have coarse loamy textures. The Togye soil profiles are similar to the Hwabong soils except the Togye contains between 10 and 35 percent fine and medium gravel and occurs in alluvial fan positions whereas the Hwabong soils occur on flood plains and contain little or no gravel (less than 10 percent). The Hwabong soils are more stratified, deeper, and have more homogeneous textures. The Seongsan soils occur in similar positions but have coarse loamy textures and redder colors throughout the control section. The Nagdong soils are in the same texture family but contain more fine sand and are gravel free throughout. The Ibseog soils belong to the sandy skeletal texture family.

Setting: The Togye soils are on nearly level to gently sloping alluvial foot slopes and fans. Slopes are mostly from 2 to 7 percent but range from 2 to 15 percent. The Togye soils are formed in alluvial-colluvial material derived from coarse textured micaceous soils underlain by acidic crystalline rocks.

Principal Associated Soils: In addition to the competing Bonryang, Hwabong and Seongsan soils, the Samgag, Jeonnam, Gwangsan and Sachon soils are associated. Samgag soils are developed in residual granitic materials in uplands and have cambic B horizons. The Jeonnam and Gwangsan soils are developed in residual granitic material, have red colors and Bt horizons. The Sachon soils have gray mottles between 50 and 100 cm. and coarse loamy textures.

Drainage and Permeability: Excessively drained. Runoff is slow to medium. Permeability is very rapid.

Use and Vegetation: Most areas are used for upland crops such as barley, soybean and tobacco.

Distribution and Extent: The Togye soils are of small extent and occur in small areas throughout the country.

Series Established: Gwangju City, Jeollanam Do, Seosan Dong, March 1967.

Remarks: Similar soils containing little or no gravel have been included in the mapping to date. If sufficiently extensive, this soil should be established as a new series.

Lab. Nos. Cg221-222 Typifying Pedon

Depth cm	Hori- zon	Gra- vel >2mm	Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 9	Ap	11.4	15.8	21.8	17.9	14.9	7.2	16.7	5.7	LCoS	58.2	25.4	10.7	CoSL
9-100	C	10.7	17.1	20.9	16.6	15.7	8.8	13.7	7.2	LCoS	56.9	28.7	7.2	LCoS

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Sat. %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
22.1	10.4	4.2	5.7	4.1	0.48	3.6	1.50	0.90	0.00	0.15	-	70.8	-
19.7	9.7	4.0	5.7	3.9	0.19	2.9	0.45	0.90	0.03	0.08	-	50.3	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
12 November, 1969

TONGCHEON SERIES

The Tongcheon series is a member of loamy skeletal, mixed, mesic family of Aquic Dystrochrepts (Alluvial soils). These soils have moderately thick dark grayish brown sandy loam Apg horizons and moderately deep brown silt loam to sandy loam cambic B horizons with about 15 percent gravel and few mottles. C horizons are very deep brown gravelly sandy loam or loam mottled with gray. These soils are formed on very gently sloping gravelly alluvial plains in mountain valleys.

Typifying Pedon: Tongcheon sandy loam - paddy rice rotated with nonirrigated barley (Field description Ulsan Si and Ulju Gun No. 112; colors are for moist soil.)

Ap1g -- 0 to 17 cm. Very dark gray (10YR 3/1) sandy loam; few fine and medium faint brown to dark brown (10YR 4/3) mottles; puddled structure breaking when drained to weak coarse prismatic which breaks to weak coarse blocky; crushed color very dark gray (10YR 3/1); friable, slightly sticky and nonplastic; few fine medium and coarse continuous vertical inped simple tubular pores; few small and medium gravel pebbles; common very fine muscovite mica; common medium dead rice roots; abrupt smooth boundary; pH 5.5.

Ap2g -- 17 to 27 cm. Dark grayish brown (10YR 4/2) sandy loam; common medium distinct brown to dark brown (7.5YR 4/4) mottles; crushed color grayish brown to dark brown (7.5YR 4/4); puddled structure cracking when drained to weak coarse prismatic which breaks to weak medium and coarse platy and some subangular blocky; slightly firm, slightly sticky and slightly plastic; patchy thin accumulations of Fe oxides on ped faces and in few large earthworm holes; common fine and medium continuous vertical and oblique inped simple open tubular pores; few pebbles as above; many fine muscovite mica; few fine to medium dead rice roots; gradual smooth boundary; pH 5.0.

B -- 27 to 51 cm. Brown to dark brown (7.5YR 4/4) gravelly sandy loam; faintly mottled with dark grayish brown (10YR 4/2); crushed color brown to dark brown (7.5YR 4/4); weak medium and coarse subangular blocky structure; slightly firm, slightly sticky and slightly plastic; few continuous thin vertical gray cutans diminishing with depth to none below 40 cm.; common medium and sometimes coarse continuous vertical and oblique inped and exped simple open tubular pores; about 15 percent hard mixed gravel; common fine mica as above; few fine dead rice roots; clear smooth boundary; pH 5.5.

C1 -- 51 to 112 cm. Dark reddish brown (5YR 2/2) very gravelly sandy loam; few gray mottles below 75 cm. increasing with depth; structureless, stratified; friable, sticky and plastic; common medium and coarse continuous vertical inped dendritic open tubular pores; about 40 or 50 percent moderately rounded gravel and cobbles from mixed acidic rock source materials; few fine mica; no roots; gradual smooth boundary; pH 5.5.

C2 -- 112 to 150 cm. Mottled grayish brown (10YR 5/2) and brown to dark brown (7.5YR 4/4) very gravelly sandy loam; structureless, stratified; loose, nonsticky and nonplastic; between 50 and 90 percent fragments as above; pH 5.5.

Type Location: Ulju Gun, Gyeongsangnam Do, 300 meters southwest Hyangsan Primary School, Hyangsan Ri, Sangbug Myeon.

Range in Characteristics: The solum thickness averages about 70 cm. and ranges from 50 to 100 cm. Gravel and cobble content ranges from 5 to 35 percent in the solum and from 35 to 90 percent in the C horizons. Depth to bedrock is probably 3 to 5 meters or more. Reaction is strongly to medium acid and base saturation is high, though it varies considerably. Apg horizons are 20 to 30 cm. thick, grayish brown, dark grayish brown, very dark grayish brown, olive gray or very dark gray sandy loam or silt loam with some gravel. The B horizons are moderately deep brown, dark yellowish brown or brown to dark brown gravelly loam, silt loam or sandy loam with at least one sub-horizon with few or no gray mottles. C horizons are brown to dark brown very gravelly to very cobbly sandy loam or loamy fine sand beginning between 50 and 100 cm. with gray water table mottles increasing with depth.

Competing Series and Their Differentiae: These are the Maryeong, Jungdong, Sachon, Sangju, Hagsan, Seongsan and Bonryang soils. The Maryeong soils have loamy skeletal textures and reddish brown colors. Jungdong, Seongsan and Sangju soils have coarse loamy textures, lack gray ground water table mottles above 100 cm. and are well drained. The Hagsan soils have fine loamy over sandy textures. The Bonryang soils have coarse loamy over sandy textures and are well drained. The Sachon soils have coarse loamy textures and gray mottles throughout.

Setting: The Tongcheon soils occur on level to nearly level alluvial plains in mountain valleys. Dominant slopes are about 1.0 or 1.5 percent and the range is from 0 to 3 percent.

Principal Associated Soils: The Sachon, Sangju and Jisan soils are frequently associated in local alluvial positions above the Tongcheon soils. The Bonryang and Hagsan soils may be associated in similar physiographic positions. The Hwabong and Hwangryong soils are associated in natural levee positions near river channels.

Drainage and Permeability: The Tongcheon soils are moderately well drained. Permeability is moderately rapid. Runoff is very slow as most areas are level terraced and dyked for rice paddy land use.

Use and Vegetation: Most of these soils are used for flood irrigated paddy rice during the wet summer, and nonirrigated barley during dry winter seasons.

Distribution and Extent: The Tongcheon soils are of limited extent and occur throughout the country in mountain valleys.

Series Established: Ulju Gun, Gyeongsangnam Do, Tongcheon Ri, Ungchon Myeon, August 1967.

Remarks: Most gravel and cobbles were discarded from the samples and no calculated quantities are available. Farmers commonly remove coarse fragments from plow layers.

Lab. Nos. U575-579 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 17	Ap1g	2.7	1.0	4.9	13.7	21.1	11.8	30.8	16.7	SL	24.4	36.1	22.8	CL
17- 27	Ap2g	0.6	1.0	4.8	12.5	20.7	13.7	33.7	13.6	SL	23.3	40.8	22.3	L
27- 51	B	2.8	1.0	4.4	9.9	14.1	8.2	43.3	19.1	L	18.7	31.1	31.1	CL
51-112	C1	9.6	2.1	8.1	13.6	12.9	5.5	33.2	24.6	L	27.3	23.7	24.4	CL
112-150	C2	16.9	3.9	11.8	24.0	24.9	8.1	16.8	10.5	SL	47.6	31.0	10.9	CoSL

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
	33.4	9.8	4.5	3.5	3.70	5.80	2.30	0.30	0.24	0.10	—	50.0	—
	22.6	7.1	4.9	3.7	1.46	5.64	1.50	0.30	0.22	0.10	—	38.0	—
	28.5	9.4	5.3	4.1	1.17	10.16	3.20	0.30	0.18	0.10	—	37.0	—
	23.9	10.3	5.5	4.3	1.82	12.90	5.00	0.90	0.20	0.20	—	49.0	—
	13.5	5.6	6.0	4.5	0.85	10.20	2.10	0.70	0.16	0.20	—	31.0	—

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
12 November, 1969

ULSAN SERIES

The Ulsan series is a member of the coarse loamy, mixed, mesic family of Typic Dystrochrepts (Lithosols). These soils have thin yellowish brown to dark brown silt loam A horizons and moderately deep strong brown to reddish yellow loam or silt loam cambic B horizons. C horizons are yellow or reddish yellow sandy loam residual andesite porphyry saprolite. They occur in hilly to mountainous areas.

Typifying Pedon: Ulsan silt loam - pine forest (Field description Ulju Gun profile No. 10; colors are for moist soil.)

A -- 0 to 30 cm. Yellowish brown (10YR 5/4) silt loam; moderate very fine and medium granular structure; friable, slightly sticky and slightly plastic; common fine and medium roots; clear smooth boundary.

B -- 30 to 50 cm. Reddish yellow (7.5YR 6/8) loam; weak medium and coarse subangular blocky structure; firm, slightly sticky and slightly plastic; few fine continuous random inped simple tubular pores; common fine prominent very pale brown (10YR 8/3) exped mottles in lower part of the horizon; common fine and medium roots; clear wavy boundary.

C1 -- 50 to 75 cm. Reddish yellow (7.5YR 6/8) sandy loam; structureless (massive) firm, slightly sticky and nonplastic; few fine roots; diffuse wavy boundary.

C2 -- 75 to 100 cm. Yellow (10YR 8/8) sandy loam; structureless (massive); firm, nonsticky and nonplastic; few fine black (10YR 2/1) concretions.

Type Location: Ulsan City, Gyeongsangnam Do, about 200 meters north of Taehwa 2 Ri.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is mainly less than 2 meters. Base saturation is commonly less than 60 percent. Reaction is medium to slightly acid. Few rock outcrops and gravel generally occur in these soils. A horizons are 5 to 20 cm. thick, brown to dark brown or where eroded dark yellowish brown or yellowish brown silt loam, loam or very fine sandy loam. Cambic B horizons are 50 to 100 cm. thick, yellowish brown, dark yellowish brown, strong brown or reddish yellow silt loam, loam or fine sandy loam with 7.5YR or 10YR hues. C horizons are reddish yellow, yellow, light yellowish brown, yellowish brown pale brown or brownish yellow fine sandy loam or sandy loam weathered andesite porphyry saprolite.

Competing Series and Their Differentiae: These include the Taehwa, Bonggye, Gwanag, Odae, Mudeung, Samgag and Songjeong series. The Taehwa soils have fine loamy textures and argillic B horizons. The Bonggye soils have red colors and fine clayey argillic B horizons. The Gwanag soils are shallow over hard granitic bedrocks. The Odae soils are shallow over hard granitic bedrocks and have umbric epipedons. The Mudeung soils have fine loamy textures and hard bedrock within 50 cm. of the surface. The Samgag soils contain mica, have thicker very deep saprolite and are derived from granitic materials. The Songjeong soils have fine loamy textures, red argillic B horizons, contain mica and are derived from granitic materials.

Setting: The Ulsan soils are formed on sloping to steep hilly or mountainous areas in residual porphyritic materials. Dominant slopes are 30 to 60 percent and the range is from 7 to about 75 percent.

Principal Associated Soils: The Bonggye, Mudeung and Taehwa soils are associated. Generally, the Bonggye soils occupy smoother positions than the Ulsan and Mudeung soils. The Taehwa soils occur in similar physiographic positions.

Drainage and Permeability: Somewhat excessively drained. Permeability is probably moderate and runoff is rapid.

Distribution and Extent: The Ulsan soils are of small extent and are distributed mostly in the southern part of the country in porphyry areas.

Series Established: Ulsan City, Gyeongsangnam Do, 1969.

Remarks: To date this series has been included in areas mapped as Taehwa.

Lab. Nos. U86-89 Typifying Pedon

Depth cm	Horizon	Gravel 2mm	VCS >2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
			Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture								International			
0-30	A	1.0	—0.2—		2.5	24.7	11.1	52.1	9.4	SiL	7.5	45.7	37.4	L
30-50	B	0.0	—0.1—		2.4	29.2	12.6	44.6	11.1	L	9.3	52.1	27.5	L
50-75	C1	0.0	—0.1—		4.0	34.0	14.4	38.0	9.5	SL	13.0	56.9	20.6	FSL
75+	C2	0.2	0.1	0.3	4.9	38.9	18.1	29.7	8.0	SL	15.6	62.5	13.9	FSL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	S.G.	pH H_2O (1:1)	pH 1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg	Na	K	H	Base Sat. % CEC	Sum of Cations
							me/100g							
	22.5	7.1	2.65	5.4	3.9	0.50	3.80	0.40	0.35	0.05	0.11	-	23.3	-
	22.1	9.0	2.67	5.4	3.7	0.10	6.90	0.15	1.45	0.08	0.13	-	26.2	-
	19.7	8.7	2.67	5.5	3.7	0.04	6.80	0.15	2.75	0.24	0.14	-	48.2	-
	15.8	5.6	2.67	5.8	3.9	0.10	4.30	0.15	2.35	0.16	0.12	-	64.7	-

Elemental Analysis of Clay SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %
2.50	51.23	4.85	31.69	2.61
2.25	49.07	4.76	33.98	2.33
2.12	47.35	5.25	34.63	2.33
-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
HSY, KBJ, UKT, JFD
12 November, 1969

UNGYO SERIES

The Ungyo series is a member of the fine clayey, mixed, mesic family of Humic Hapludults (Red-Yellow Podzolic soils). These soils have moderately thick dark brown cobbly loam Ap horizons and deep yellowish red cobbly silty clay loam to clay loam Bt horizons. C horizons are yellowish red very cobbly clay loam. They are developed in very deep moderately dissected mountain colluvium and fan terraces derived from acidic crystalline materials.

Typifying Pedon: Ungyo cobbly silt loam - corn (Field description Pyeongchang Gun profile No. 130; colors are for moist soil.)

Ap -- 0 to 15 cm. Dark brown (10YR 3/3) gravelly to cobbly silt loam; moderate fine granular structure; friable, slightly sticky and slightly plastic; approximately 20 percent unweathered angular granitic gravel and cobbles; few fine yellowish mica flakes; common fine dead corn roots; abrupt smooth boundary; pH 5.5.

B1 -- 15 to 25 cm. Dark yellowish brown (10YR 4/4) gravelly to cobbly silt clay loam; weak fine and medium subangular blocky structure; firm, sticky and plastic; few fine and medium discontinuous random inped simple tubular pores; approximately 25 percent gravel and cobbles as above; mica as above; few fine dead corn roots; clear smooth boundary; pH 5.0.

B2t -- 25 to 65 cm. Strong brown (7.5YR 5/6) cobbly silty clay; moderate medium to coarse subangular blocky structure; firm, sticky and plastic; moderately thick discontinuous clay cutans; few fine to medium discontinuous random inped simple tubular pores; gravel and cobbles as above; mica as above; few fine dead corn roots; diffuse smooth boundary; pH 5.0.

B3 -- 65 to 100 cm. Yellowish red (5YR 5/6) stony silty clay loam; moderate fine to medium subangular blocky structure; firm, sticky andplastic; thin discontinuous clay cutans; few fine discontinuous random inped simple tubular pores; approximately 30 percent stones and cobbles as above; common mica as above; no roots; pH 5.0.

C -- 100 to 120 cm. Yellowish red (5YR 5/6) very cobbly to stony silty clay loam; weak medium and coarse subangular blocky structure; firm, sticky and plastic; approximately 80 percent cobbles and stones as above; common mica as above; no samples collected.

Type Location: Pyeongchang Gun,Gangweon Do, about 1 km. west of Sogsa Ri, Jinbu Myeon.

Range in Characteristics: Solum thickness ranges from about 90 cm. to 150 cm. Depth to hard rock is more than 200 cm. probably ranging from about 2 meters to more than 5 meters. Reaction ranges from strongly to medium acid except where limed. Base saturation is usually less than 35 percent. Most areas have from 10 to 35 percent angular and subangular granite or granite gneiss cobbles, gravel and stones on the surface and throughout the profiles except where farmers have removed the larger fragments from the Ap horizons. The Ap or A1 horizons are dark brown, very dark brown, very dark grayish brown or sometimes black gravelly or cobbly silt loam, loam or light silty clay loam with more than 1.0 percent organic matter. A horizon thickness is dominantly 15 to 25 cm. and ranges from 15 to 30 cm. Bt horizons are yellowish red, red or strong brown gravelly to cobbly silty clay loam, clay loam, silty clay or clay. C horizons are yellowish red, strong brown or yellowish brown very gravelly, very cobbly or stony silty clay loam, clay loam, silt loam or loam sometimes weakly stratified.

Competing Series and Their Differentiae: The competing soils are in the Mitan, Gaghwa, Pyeongan, Jangweon, Anyang and Wangsan series. The Mitan soils have clayey skeletal textures and occur in limestone areas. The Gaghwa soils lack dark colored surface layers. The Pyeongan soils have near neutral reaction, high base saturation and occur in limestone areas. The Jangweon soils lack dark colored A horizons, have somewhat coarser textures and fragipan layers in the B horizon. The Anyang soils lack dark colored A horizons and have more yellow B horizons. The Wangsan soils lack coarse fragments in the solum.

Setting: The Ungyo soils are formed in deep moderately dissected unconsolidated mountain colluvium in colluvial and fan terrace positions in soil materials derived from granite, granite gneiss, and similar materials in areas with cool moist climate. Frost free days are approximately 170 to 180. Slopes range from 7 to 60 percent but dominant slopes 15 to 35 percent.

Principal Associated Soils: These are the Gaghwa, Wangsan, Sinbul and Weoljeong soils. The Gaghwa soils occur in similar landscape positions and lack the dark colored A horizon. The Wangsan soils lack coarse fragments and occur on stream terraces. The Sinbul soils have dark colored A horizons, loamy skeletal textures and occur in mountain colluvium on steep slopes above the Ungyo soils. The Weoljeong soils are developed in coarse loamy granitic residuum sometimes adjacent to the Ungyo soils.

Drainage and Permeability: Well drained. Permeability is probably moderately slow or slow. Runoff is rapid.

Use and Vegetation: Most areas are cultivated for corn, soybean, radish and similar crops. A small extent, generally on the steeper slopes, grows pine and mixed hardwood forest.

Distribution and Extent: These soils are of small extent and occur in the central and northern parts of the country.

Series Established: Pyeongchang Gun, Gangweon Do, November, 1968.

Remarks: Cobbles, stones and the larger gravel were not included in the samples and are not noted in the analytical data. The Ungyo series is more on less equal to the Gaghwa series except for having dark A horizons relatively high in organic matter.

Lab. Nos. Mh307-310 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 15	Ap	1.3	1.4	1.7	1.7	1.1	1.0	62.2	30.9	SiCL	5.1	15.2	48.8	SiC
15- 25	B1	0.0	——	3.2	——	0.8	1.2	65.4	29.4	SiCL	3.4	13.3	53.9	SiC
25- 65	B2t	5.9	——	4.9	——	0.9	2.0	53.9	38.3	SiCL	5.2	10.4	44.1	LiC
65-100	B3	21.6	7.7	9.8	10.6	7.0	4.9	30.4	29.6	CL	29.5	16.9	24.0	LiC

Moisture Retention %			pH		O.M.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
64.4	50.1	20.7	5.1	3.8	7.54	18.6	4.05	0.60	0.05	0.13	—	26.0	—
43.8	37.5	13.8	5.1	3.8	1.93	8.9	0.65	0.50	0.02	0.25	—	16.0	—
36.9	32.8	16.7	5.1	3.7	0.79	8.2	2.25	0.45	0.15	0.20	—	37.2	—
38.0	32.0	17.2	5.3	3.9	1.04	10.6	1.50	0.60	0.10	0.15	—	22.2	—

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
HSY, KPJ, UKT, JFD
13 November, 1969

WANGSAN SERIES

The Wangsan series is a member of the fine clayey, mixed, mesic family of Humic Hapludults (Red-Yellow Podzolic soils). These soils have moderately thick very dark brown silt loam A horizons which are medium to high in organic matter content, very deep, dark brown to yellowish red heavy silty clay loam Bt horizons and very thick strong brown stratified gravelly fine loamy C horizons. They are developed on medium to high terraces in old alluvium derived chiefly from granitic source materials.

Typifying Pedon: Wangsan silt loam, eroded - radish (Field description Pyeongchang Gun profile No. 118; colors are for moist soil.)

Ap -- 0 to 15 cm. Very dark brown (10YR 2/2) silt loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; few fine round quartz gravel; few fine roots; abrupt smooth boundary; pH 5.0.

B11t -- 15 to 40 cm. Dark yellowish brown (10YR 3/4) silty clay loam; weak coarse subangular blocky structure breaking under moderate hand pressure to fine medium subangular and some granular; friable to firm, sticky and slightly plastic; patchy thin clayey krotovinas; few fine and coarse continuous inped simple tubular pores; few fine roots; clear wavy boundary; pH 5.5.

B12t -- 40 to 52 cm. Dark yellowish brown (10YR 4/4) silty clay loam; weak coarse subangular blocky breaking to moderate medium and fine subangular blocky structure; firm, sticky and plastic; few patchy thin clay cutans; common fine and coarse continuous inped simple tubular pores; few large worm holes; gradual wavy boundary; pH 6.0.

B2t -- 52 to 80 cm. Dark brown (7.5YR 4/4) silty clay loam; moderate medium and coarse subangular blocky structure; firm, sticky andplastic; patchy thin clay cutans; few fine and medium continuous inped simple tubular pores; few fine round quartz gravel in lower part; few fine yellow mica flakes; few large worm casts; clear wavy boundary; pH 6.0.

B1tb -- 80 to 130 cm. Yellowish red (5YR 4/6) light clay loam; moderate coarse subangular blocky structure; firm, slightly sticky andplastic; patchy moderately thick clayey krotovinas and cutans; few fine round quartz gravel; few medium and coarse discontinuous simple tubular pores; clear wavy boundary; pH 6.0.

B2tb -- 130 to 150 cm. Yellowish red (5YR 5/8) silty clay; moderate medium and coarse subangular blocky structure; firm, very sticky and very plastic; few small angular and round quartz gravel; few fine yellowish mica; pH 6.0.

Type Location: Pyeongchang Gun, Gangweon Do, about 500 meters northwest of Hoenggye Police Box, Hoenggye Ri, Jinbu Myeon.

Range in Characteristics: Solum thickness ranges from 125 to 200 cm. or more. Depth to hard rock is normally more than 3 meters and probably less than 10 meters. Reaction is strongly to medium acid except where limed and the base saturation is less than 35 percent except for the A horizons where it is less than 60 percent. Similar to the Gwangju series, these soils may have grit free silty clay loam mantles over fine clayey old alluvial Btb horizons with grit and some gravel. Few fine quartz grit and gravel may occur throughout the profiles. A1 horizons are dark brown, very dark brown or dark grayish brown silt loam 15 to 30 cm. thick with more than 1.0 percent organic matter. A horizons may be more thin, contain somewhat less organic matter, dark yellowish brown colors and finer textures where eroded. The upper Bt horizons are strong brown, dark brown or dark yellowish brown silty clay loam or clay loam grading to yellowish red, reddish brown or dark reddish brown heavy silty clay loam, heavy clay loam, silty clay or clay in the B3 horizons. Buried soil may underlie the solum. The C horizons are strong brown, dark yellowish brown or yellowish brown stratified gravelly silt loam, loam, sandy loam, very fine sandy loam or sandy clay loam. C horizons may be nongravelly and contain relic gray water table mottles.

Competing Series and Their Differentiae: The Bancheon, Gwangju, Hwadong, Banggi and Changpyeong series are in the same texture family. The Bancheon soils lack dark colored A horizons and have higher base saturation. The Gwangju soils lack the dark colored A horizons and are developed in granitic residuum. The Hwadong soils lack dark colored A horizons, are moderately well drained and have high base saturation. The Banggi soils lack dark A horizons and have clayey skeletal textures. The Changpyeong soils have redder colors, contain less organic matter in the A horizons and have more distinct subsoil structure.

Setting: The Wangsan soils are formed in remnants of very deep old alluvial materials on moderately dissected medium to high stream terraces derived from granite and similar materials in high mountain valleys. Slopes range chiefly from 2 to 15 percent and dominant slopes are 2 to 7 percent.

Principal Associated Soils: These are the Chahang and Imog soils. The Chahang soils have fine loamy textures, less red B horizons with weak blocky structure and deeply weathered residual granitic parent materials. The Imog soils have coarse loamy textures and occur in local alluvial-colluvial materials in narrow valleys alluvial plains and foot slope positions.

Drainage and Permeability: Well drained and moderately or slowly permeable. Runoff is medium or slow.

Use and Vegetation: These soils are planted mainly to corn, soybean, radish, potato, cabbage, and similar crops. A few areas grow pine forest and pasture grass.

Distribution and Extent: These soils are of small extent and occur near rivers in high valleys with cool moist climate in the northeastern part of the country.

Series Established: Pyeongchang Gun, Gangweon Do, November 1968.

Remarks: The typifying pedon appears to have a buried soil which is included in the range of the series but is not the central concept. The Wangsan series is more or less equivalent to the Gwangju series except for the highly organic A horizon.

Lab. Nos. Mh274-279 Typifying Pedon

			Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
Depth cm	Horizon	Gravel >2mm	VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 15	Ap	8.6	5.2	5.2	3.9	2.8	2.0	66.9	14.0	SiL	14.8	17.0	54.2	SiL
15- 40	B11t	0.0	1.5	2.3	3.0	2.6	1.7	55.2	33.7	SiCL	7.2	42.7	16.4	LiC
40- 52	B12t	0.0	—	5.4	—	2.0	1.4	56.6	34.6	SiCL	5.8	18.9	40.7	LiC
52- 80	B2t	0.0	1.7	2.3	2.9	0.8	4.5	51.9	35.9	SiCL	7.5	15.2	41.4	LiC
80-130	B1tb	0.6	6.0	7.4	9.0	4.6	7.9	37.3	27.3	CL	23.6	20.2	28.4	LiC
130-150	B2tb	0.5	2.1	3.7	5.5	5.4	4.3	37.7	41.3	C	12.1	14.7	31.9	LiC

Moisture Retention %			pH		O.M.	2/	Extractable Cations				Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
						me/100g							
54.6	43.4	18.1	4.6	3.5	6.76	18.85	0.45	0.20	0.08	0.18	-	4.8	-
54.8	43.5	26.2	4.8	3.8	4.01	14.20	0.00	0.10	0.08	0.18	-	2.5	-
51.5	42.9	19.2	5.2	3.7	3.43	13.50	0.08	0.10	0.05	0.13	-	2.7	-
36.0	33.3	16.8	5.2	3.7	1.12	11.70	0.27	0.20	0.05	0.18	-	6.0	-
30.7	27.4	11.9	5.0	3.6	0.54	9.55	1.50	0.95	0.13	0.18	-	28.9	-
36.3	31.1	17.4	4.8	3.5	0.41	14.15	1.80	1.43	0.15	0.30	-	26.0	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
HSY, KBJ, UKT, JFD
27 June, 1969

WEOLJEONG SERIES

The Weoljeong series is a member of the coarse loamy mixed, mesic family of Typic Haplumbrepts (Lithosols). These soils have moderately thick or thick very dark brown loam A horizons with high organic matter content and moderately deep yellowish brown sandy loam cambic B horizons. The C horizons are very thick yellowish brown sand to sandy loam granitic saprolite.

Typifying Pedon: Weoljeong loam - pine forest (Modified field description Pyeongchang Gun profile No. 115; colors are for moist soil.)

A11 -- 0 to 20 cm. Very dark brown (10YR 2/2) loam; moderate fine to medium granular; friable, slightly sticky and slightly plastic; few fine yellowish mica; few fine quartz grit; many fine and medium living grass roots; diffuse wavy boundary; pH 5.5.

A12 -- 20 to 44 cm. Very dark grayish brown (10YR 3/2) loam; weak coarse blocky structure breaking readily to weak fine and medium granular; friable, slightly sticky and slightly plastic; few fine yellow mica; common fine quartz grit; many fine and medium living grass roots; clear wavy boundary; pH 5.5.

B -- 44 to 71 cm. Yellowish brown (10YR 5/6) fine sandy loam; weak coarse blocky structure breaking to weak medium subangular blocky and granular; friable, slightly sticky and non plastic; common fine to medium quartz gravel; few fine mica and feldspar crystals; common fine and medium living roots; diffuse wavy boundary; pH 5.0.

C1 -- 71 to 105 cm. Yellowish brown (10YR 5/5) sandy loam saprolite; structureless (massive); friable, nonsticky and nonplastic; common fine angular quartz gravel, mica and some fine feldspar crystals; few fine living roots; clear wavy boundary; pH 4.5.

C2 -- 105 to 120 cm. Yellowish brown (10YR 5/4) loamy coarse sand saprolite of granite; structureless (massive, near rock structure); friable, nonsticky and nonplastic; pH 4.5.

Type Location: Pyeongchang Gun, Gangweon Do, about 100 meters east of the Alpine Experiment Station, Office of Rural Development, Hoenggye Ri, Doan Myeon.

Range in Characteristics: Solum thickness is commonly about 60 cm. and ranges from 50 to 100 cm. Depth to hard rock is greater than 150 cm. Probably ranging to more than 10 meters. Rock outcrops may or may not occur. Reaction is strongly to medium acid throughout the control section. Few fine yellow mica and common fine quartz grit occur throughout the profiles. Primary minerals commonly are within the first 50 cm. Base saturation is less than 50 percent. A horizons are dark brown to very dark brown or black loam or sandy loam. The cambic B horizons are yellowish brown, strong brown or dark yellowish brown sandy loam, fine sandy loam or loam. C horizons are yellowish brown, strong brown or pale yellow coarse sand, coarse sandy loam or loamy sand.

Competing Series and Their Differentiae: These are the Samgag, Mudeung, Sinbul, Gwanag and Odae soils. The Samgag soils lack thick dark A horizons and the shallow Mudeung soils have fine loamy textures. The Sinbul soils belong to the loamy-skeletal texture family and occur in landscape positions receiving soil accumulations. The coarse loamy Gwanag soils are shallow and lack an umbric epipedon. The Odae soils are shallow.

Setting: The Weoljeong soils occur in hilly and mountainous areas at high elevations with cool humid climate and residual granitic parent materials. Slopes range from 25 to 90 percent or more and dominant slopes are in excess of 40 percent.

Principal Associated Soils: The Gwanag, Odae, Chahang and Imog soils are associated. The Chahang soils have very thick cambic B horizons and fine loamy textures. The Imog soils are deep coarse loamy soils with dark colored A horizons developed in local alluvial-colluvial materials. The Odae soils are shallow over hard rock at less than 50 cm.

Drainage and Permeability: Well drained. Permeability is moderate or rapid. Runoff is slow before soil saturation when it may become moderately rapid or rapid depending on the slope. Infiltration is probably rapid and down slope subsurface water movement is probably rapid.

Use and Vegetation: These soils grow mainly pine and some hardwood forest. Vegetable and seed crops are grown in a few small areas.

Distribution and Extent: These soils are of small extent in high mountainous areas with cool moist climate and granitic geology chiefly in the northeastern part of the country.

Series Established: Pyeongchang Gun, Gwangweon Do, Nov. 1968.

Lab. Nos. Mh264-268 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % U. S. Department of Agriculture VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 20	A11	5.8	9.9	9.9	14.1	9.7	6.6	34.2	15.6	L	36.1	22.5	25.8	CL
20- 44	A12	2.9	5.2	10.3	7.8	13.3	6.9	43.8	12.7	L	25.9	37.9	23.5	L
44- 71	B	3.0	7.7	15.5	25.0	15.0	6.5	23.5	6.8	SL	51.3	24.4	17.5	SL
71-105	C1	10.0	12.6	21.0	27.2	14.7	10.4	13.8	0.3	S	64.5	27.6	7.6	S
105-120	C2	14.2	16.2	25.2	25.8	15.4	7.1	10.4	0	S	69.9	24.2	5.9	S

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations Ca	Mg	Na	K	H	Base Saturation % CEC	Sum of Cations
						me/100g							
-	-	-	5.2	3.9	8.14	16.90	1.45	0.50	0.10	0.15	-	13.0	-
42.7	34.3	13.8	5.3	4.1	3.87	9.10	0.15	0.00	0.05	0.08	-	3.1	-
31.9	23.7	8.9	5.9	3.9	0.81	4.30	0.20	0.00	0.10	0.05	-	8.1	-
25.0	17.0	5.9	6.2	4.0	0.40	2.60	0.30	0.00	0.10	0.02	-	16.2	-
22.2	15.4	5.1	6.4	3.9	0.13	2.60	0.30	-	-	-	-	-	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
13 November, 1969

YEONGSAN SERIES

The Yeongsan series is a member of the fine loamy over sandy, mixed, mesic family of Typic Ochraqualfs (Low-Humic Gley soils). These soils have moderately thick gray or grayish brown loam Apg horizons and moderately deep gray clay loam Btg horizons with common distinct mottles. The Cg horizons are very deep grayish brown stratified sandy loam to sand with few or no mottles. They are formed in stratified alluvial materials and occur in low terrace and second bottom positions on broad continental alluvial plains.

Typifying Pedon: Yeongsan loam - paddy rice (Field description Gwangsan Gun profile No. 140; colors are for moist soil.)

Ap1g -- 0 to 12 cm. Gray (5Y 5/1) loam; few fine prominent brown to dark brown (7.5YR 4/4) mottles; puddled structure cracking when drained to weak coarse prismatic which breaks to weak coarse blocky; friable, slightly sticky and slightly plastic; few fine continuous random pores; few fine mica flakes; common fine roots; clear smooth boundary.

Ap2g -- 12 to 23 cm. Gray (N5/) light clay loam; common fine medium prominent yellowish red (5YR 5/6) and dark reddish brown (2.5YR 3/4) mottles; weak coarse platy structure; firm, slightly sticky and slightly plastic; common fine continuous vertical pores; few fine mica flakes; few fine rice roots; abrupt smooth boundary.

B21tg -- 23 to 36 cm. Olive gray (5Y 5/2) clay loam; many medium to coarse prominent yellowish brown (10YR 5/6) and yellowish red (5YR 4/6) mottles; moderate coarse prismatic structure breaking to weak coarse blocky; firm, sticky and plastic; patchy thin clayey cutans; many fine continuous pores; few fine mica flakes; few fine rice roots; clear smooth boundary.

B22tg -- 36 to 55 cm. Gray (5Y 5/1) clay loam; few fine and medium prominent yellowish red (10YR 5/6) mottles; strong coarse prismatic structure; breaking to moderate medium and coarse subangular blocky; firm, very sticky and very plastic; moderately thick clayey cutans; many fine continuous pores; few fine mica flakes; very few fine roots; abrupt smooth boundary.

B3g -- 55 to 72 cm. Olive gray (5Y 5/2) loam; many fine to medium distinct yellowish red (10YR 5/8) mottles; moderate coarse prismatic structure; slightly sticky and slightly plastic; many fine vertical pores; few fine mica flakes; few fine rice roots; abrupt smooth boundary.

C1g -- 72 to 120 cm. Grayish brown (10YR 5/2) sandy loam; few fine distinct dark reddish brown (5YR 3/4) mottles; structureless (massive); nonsticky and nonplastic; common fine pores; few fine mica flakes; abrupt wavy boundary.

C2g -- 120 to 130 cm. Grayish brown (10YR 5/2) sand; structureless (single grain); loose, nonsticky and nonplastic.

Type Location: Gwangsan Gun, Jeollanam Do, about 200 meters northwest of Yeongsan Ri, Ponryang Myeon.

Range in Characteristics: Solum thickness ranges from 50 to 100 cm. and depth to hard rock is probably more than 5 meters. Base saturation of the solum is more than 60 percent. Reaction is medium to slightly acid throughout the profile. Apg horizons are gray, grayish brown, dark grayish brown, olive gray or light gray loam, silty clay loam, silt loam or clay loam with mottles. Bt horizons are gray, grayish brown, dark grayish brown or olive gray clay loam, loam, silty clay loam or silt loam with common yellowish red, yellowish brown or strong brown mottles. Clay content of the Bt horizon ranges from 18 to 35 percent. Cg horizons are grayish brown, dark grayish brown, dark gray or olive gray stratified sandy loam, sand or loamy sand with few or no mottles.

Competing Series and Their Differentiae: Related soils are in the Sinheung, Hagseong, Gangdong, Jisan, Manseong and Honam series. The Sinheung have cambic B horizons rather than argillic. The Hagseong soils have fine silty over sandy textures, cambic B horizons and occur on fluvio-marine plains. The Gangdong soils have fine loamy over sandy textures and cambic B horizons. The Jisan soils have fine loamy textures and occur in narrow local valley alluvium. The Manseong soils have fine loamy over sandy textures, more mottles and imperfect drainage. The Honam soils have fine clayey textures.

Setting: The Yeongsan soils are on nearly level to very gently sloping broad alluvial plains. They are formed in stratified continental alluvial materials. Slopes are dominantly about 0.5 percent and range to 2.0 percent.

Principal Associated Soils: The Sinheung, Honam, Gangdong and Sugye soils are associated in similar physiographic positions. The Sugye soils have fine silty textures.

Drainage and Permeability: Poorly drained. Permeability is probably moderate. Runoff is very slow as all areas are level terraced and dyked for rice paddy land use.

Use and Vegetation: Most areas are used for flood irrigated rice and some areas are also used for nonirrigated barley and wheat during dry winter and spring seasons.

Distribution and Extent: The Yeongsan soils are of moderate extent and are distributed on broad alluvial plains along the main rivers throughout the country.

Series Established: Gwangsan Gun, Jeollanam Do, 1966.

Remarks: This soil has in the past been considered imperfectly drained because it can be double cropped.

Lab. Nos. K410-415 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 12	Ap1g	4.5	2.8	5.6	6.2	9.6	7.8	46.6	21.4	L	16.7	29.4	32.5	CL
12- 23	Ap2g	7.4	4.1	5.7	5.8	8.8	6.9	48.7	20.0	L	17.4	29.7	32.9	CL
23- 36	B21tg	0.9	1.6	2.5	3.5	8.8	7.7	48.4	27.5	CL	9.0	30.3	33.2	LiC
36- 55	B22tg	0.4	0.6	1.6	3.5	11.0	7.5	45.7	30.1	CL	7.6	30.9	31.4	LiC
55- 72	B3g	0.0	0.4	2.7	6.6	11.9	8.8	44.4	25.2	L	12.1	32.2	30.5	LiC
72-120	C1g	0.0	0.3	4.7	25.2	27.5	9.0	21.2	12.1	SL	39.5	35.0	13.4	SL

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	pH: H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations (me/100g): Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	34.6	11.8	4.5	3.6	3.00	8.88	2.90	1.30	0.28	0.22	-	52.9	-
	31.7	11.4	4.8	3.6	2.33	8.44	3.20	0.50	0.18	0.16	-	47.6	-
	32.7	15.2	6.3	5.0	1.32	8.60	6.30	1.70	0.24	0.12	-	97.9	-
	31.3	17.4	6.3	5.1	0.81	9.68	6.90	1.90	0.20	0.16	-	94.9	-
	32.6	14.0	6.3	5.1	0.71	9.42	6.90	1.90	0.20	0.20	-	98.0	-
	15.3	5.2	5.0	4.2	0.25	4.80	3.40	0.80	0.22	0.14	-	96.0	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
13 November, 1969

YONGJI SERIES

The Yongji series is a member of the fine loamy, mixed, mesic family of Aquic Fluventic Eutrochrepts (Alluvial-Red-Yellow Podzolic soils). These soils have moderately thick grayish brown silt loam Apg horizons and deep yellowish brown silty clay loam cambic B horizons with gray mottles. C horizons may be grayish brown mottled weakly stratified silt loam, loam or sandy loam. These soils are formed in local alluvial materials in narrow valley alluvial plains and on alluvial fans.

Typifying Pedon: Yongji silt loam - rice paddy (Field description Gimje Gun profile No. 67; colors are for moist soil.)

Ap1g -- 0 to 10 cm. Grayish brown (10YR 5/2) silt loam; few fine prominent yellowish red (5YR 5/8) mottles; puddled structure cracking when drained to weak coarse prismatic breaking to weak coarse blocky; firm, slightly sticky and slightly plastic; few fine pores; few fine yellowish mica flakes; abundant fine roots; gradual smooth boundary.

Ap2g -- 10 to 16 cm. Grayish brown (10YR 5/2) silt loam; weak very coarse prismatic structure breaking to weak medium and coarse platy and fine blocky; firm, sticky and plastic; common fine pores; mica as above; clear smooth boundary.

B1g -- 16 to 30 cm. Dark grayish brown (10YR 4/2) silt loam; common fine distinct brown to dark brown (7.5YR 4/4) and fine strong brown (7.5YR 5/6) mottles; crushed color grayish brown (2.5Y 5/2); moderate coarse prismatic structure breaking to moderate medium and coarse blocky; continuous thick gray cutans on prisms; firm, sticky and plastic; common fine pores; common fine mica flakes; few fine roots; clear smooth boundary.

B21 -- 30 to 45 cm. Yellowish brown (10YR 5/4) silty clay loam; strong coarse prismatic structure breaking to weak very coarse subangular blocky; continuous thick gray cutans; some black Mn inprism concretions; crushed color yellowish brown (10YR 5/4); firm, sticky and plastic; common fine vertical continuous pores; mica as above; very few fine roots; diffuse smooth boundary.

B22 -- 45 to 80 cm. Mottled grayish brown (2.5Y 5/2), strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/4) silty clay loam; crushed color pale brown (10YR 6/3); strong very coarse prismatic structure; continuous thick gray cutans; few fine black (5YR 2/1) Mn inprism concretions; firm, sticky and plastic; pores as above; mica as above; clear smooth boundary.

B3 -- 80 to 120 cm. Light yellowish brown (10YR 6/4) silty clay loam; many medium distinct strong brown and few black and grayish brown mottles; weak coarse prismatic structure; firm, sticky and plastic; clear smooth boundary.

Cg -- 120 to 150 cm. Mottled light brownish gray (2.5Y 6/2), dark brown (7.5YR 4/4) and black (5YR 4/1) silt loam; structureless (massive); weakly stratified; firm, slightly sticky and slightly plastic; clear smooth boundary.

Type Location: Gimje Gun, Jeollabug Do, near Bugi Ri, Yongji Myeon.

Range in Characteristics: Solum thickness ranges from 100 cm. to 150 cm. and depth over hard rock is probably more than 5 meters. Reaction is medium to slightly acid throughout and increases slightly with depth. Base saturation is more than 60 percent. Fine yellowish mica occurs throughout the profiles. Apg horizons are 20 to 30 cm. thick, grayish brown, dark grayish brown, very dark grayish brown or gray in paddy loam, silt loam, very fine sandy loam or clay loam usually with some quartz grit and fine gravel, with strong brown and yellowish red mottles. Ap horizons are brown to dark brown in uplands. Cambic B horizons are yellowish brown, strong brown or reddish brown silty clay loam, silt loam, loam or clay loam with grayish brown, dark grayish brown, gray or dark gray mottles. Cg horizons are gray to grayish brown weakly stratified loam, silt loam, silty clay loam or sandy loam with many to few black to very dark brown Mn concretions and reddish brown or yellowish brown mottles.

Competing Series and Their Differentias: These are the Gyuam, Hagsan, Samam, Yuga, Sachon, Seoggye, Sinheung, Subug, Jisan, Gangdong, Baeggu, Baegsan and Weondang series. The Gyuam soils have coarse silty textures, very deep C horizons and occur on broad alluvial plains. The Hagsan soils have fine loamy over sandy textures, deeper more stratified C horizons and occur on narrow valley alluvial plains. The Samam soils have browner colors, lack mica and are derived from reddish brown shale and sandstone soil materials. The Yuga soils have fine silty textures and occur in association with the gray shale soils. The Sachon and Seoggye soils have coarse loamy textures, grayer colors and imperfect drainage. The Sinheung, Subug, Jisan, Gangdong and Baeggu soils have grayer colors and poorer drainage. The Baegsan soils are similar except for having no gray mottles and being well drained. The Weondang soils lack gray mottles and have yellowish red or red colors.

Setting: Very gently sloping to sloping upper local valley alluvial plains, drainage divides, foot slopes and local alluvial fans in granitic areas. Slopes are mostly 5 to 10 percent and range from 2 to 30 percent.

Principal Associated Soils: The Songjeong, Jeonnam, Gwangsan, Dalcheon, Samgag and similar soils are associated in residual uplands positions. The Seongsan, Sangju, Bansan, Weondang and Baegsan soils are associated in adjacent higher well drained footslope positions. The Baeggu, Gangdong and Jisan soils are associated in lower alluvial plain positions.

Drainage and Permeability: Moderately well drained. Runoff is slow to very slow as all areas are level terraced and dyked for paddy rice land use. Permeability is probably moderately slow or slow.

Use and Vegetation: Most of these soils are used for paddy rice during wet summer and for nonirrigated barley during dry winter and spring seasons.

Distribution and Extent: The Yongji soils occur in local alluvium throughout the country chiefly in association with fine loamy and fine clayey residual granitic soils.

Series Established: Gimje Gun, Jeollabug Do, October 1967.

Lab. Nos. Dm132-138 Typifying Pedon

Depth cm	Hori-zon	Gra-vel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex-tural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Tex-tural Class
0- 10	Ap1g	4.6	4.0	5.0	3.8	4.2	3.0	54.3	25.7	SiL	13.7	21.5	39.1	LiC
10- 16	Ap2g	5.8	0.4	5.2	3.8	3.9	2.3	53.8	26.6	SiL	10.3	20.0	41.1	LiC
16- 30	B1g	2.8	5.0	5.4	4.0	3.8	2.3	53.7	25.8	SiL	15.2	18.0	40.0	LiC
30- 45	B21	1.9	2.6	3.1	2.2	2.3	1.9	60.9	27.0	SiCL	8.4	19.6	45.0	SiC
45- 80	B22	0.2	0.7	1.0	0.9	1.3	1.1	58.9	36.1	SiCL	2.9	9.7	51.3	SiC
80-120	B3	1.1	1.0	1.9	1.8	3.2	3.4	60.8	27.9	SiCL	5.4	19.2	47.5	SiC
120-150	Cg	0.9	3.2	3.8	3.4	3.2	2.0	62.2	22.2	SiL	11.2	24.3	42.3	CL

Moisture Retention % 1/10 atms	1/3 atms	15 atms	pH H2O (1:1)	1 N KCl	O.M. %	Free Fe_2O_3 %	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Sat. % CEC	Sum of Cations
40.9	38.0	14.6	5.2	4.1	2.36	1.70	8.00	1.70	0.95	0.20	0.10	1.92	36.9	60.6
37.7	34.1	12.5	5.5	4.3	1.74	1.80	6.70	2.08	1.62	0.15	0.10	0.70	59.0	84.9
36.5	33.7	14.6	5.9	4.7	1.15	1.94	7.40	2.22	2.38	0.20	0.08	0.15	65.9	97.0
38.6	36.1	18.8	6.2	5.1	0.84	2.22	8.20	2.48	3.25	0.45	0.10	0.10	76.6	98.4
46.2	44.6	24.0	6.4	5.1	0.95	2.78	11.15	2.80	5.25	0.35	0.15	0.10	76.7	98.8
43.7	42.4	17.2	6.2	4.6	0.31	2.54	10.70	2.20	5.00	2.25	0.15	0.40	71.0	95.0
30.6	30.3	10.6	6.0	4.2	0.51	1.96	8.15	1.50	2.88	0.28	0.12	0.56	58.7	89.5

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, JFD
14 November, 1969

YUGA SERIES

The Yuga series is a member of fine silty, mixed, mesic family of Aeric Fluventic Haplaquepts (Low-Humic Gley soils). These soils have moderately thick grayish brown silty clay loam Apg horizons with strong brown mottles and moderately deep mottled grayish brown and olive brown silty clay loam cambic B horizons. Cg horizons are grayish brown weakly stratified silty clay loam and silt loam with mottles and little gravel. These soils have formed in local valley alluvial plains in gray shale areas.

Typifying Pedon: Yuga silty clay loam - rice paddy (Field description Dalseong Gun profile No. 87; colors are for moist soil.)

Ap1g -- 0 to 7 cm. Grayish brown (10YR 5/2) silty clay loam; puddled structure breaks which dries and to weak medium and coarse granular; few fine faint strong brown mottles; friable, sticky and plastic; common medium pores; many fine dead roots; abrupt smooth boundary; pH 5.6.

Ap2g -- 7 to 14 cm. Olive gray (5Y 4/2) silty clay loam; weak coarse prismatic structure breaking to weak coarse platy; few medium prominent dark reddish brown mottles; firm, sticky and plastic; common fine roots; abrupt smooth boundary; pH 5.6.

B1 -- 14 to 23 cm. Olive brown (2.5Y 4/4) silty clay loam; weak medium prismatic structure breaking to moderate medium subangular blocky; common fine faint dark yellowish brown (10YR 4/4) inped mottles; thin continuous olive gray (5Y 4/2) cutans; firm, sticky and plastic; common fine pores; few fine roots; clear smooth boundary; pH 7.6.

B2 -- 23 to 50 cm. Mottled olive gray (5Y 5/2) and yellowish brown (10YR 5/4) silty clay loam; moderate coarse prismatic structure breaking to moderate medium subangular blocky; crushed color yellowish brown (10YR 5/6); firm, sticky and plastic; common medium pores; few fine roots; gradual smooth boundary; pH 7.8.

B3g -- 50 to 77 cm. Grayish brown (2.5Y 5/2) silty clay loam; weak medium to coarse prismatic structure; many fine faint strong brown (7.5YR 5/6) inped mottles; crushed color dark yellowish brown (10YR 4/4); firm, sticky and plastic; common medium pores; few fine roots; gradual smooth boundary; pH 7.8.

Cg -- 77 to 150 cm. Grayish brown (2.5Y 5/2) silt loam; structureless (massive); many fine faint dark yellowish brown (10YR 4/4) mottles; crushed color yellowish brown (10YR 5/4); pH 7.8.

Type Location: Dalseong Gun, Gyeongsangbug Do, 500 meters northwest Gobong Ri, Guji Myeon.

Range in Characteristics: Solum thickness is 50 to 100 cm. and depth to hard rock is about 100 to 300 cm. Reaction is neutral to midly alkaline. Apg horizons are 15 to 30 cm. thick, grayish brown, dark grayish brown, dark olive gray or olive gray silty clay loam or silt loam with brown mottles. B horizons are olive brown, olive, dark yellowish brown silty clay loam, clay loam, loam or silt loam with common or many grayish brown to dark grayish brown, olive gray to dark olive gray, strong brown, yellowish brown, dark yellowish brown or reddish brown mottles. Cg horizons are dominantly gray, grayish brown, dark grayish brown, olive gray or dark olive gray weakly stratified loam, silt loam or silty clay loam with various brown mottles and up to 35 percent gray shale fragments.

Competing Series and Their Differentiae: The Sugye, Sinheung, Yongji and Jisan soils are similar. The Sugye soils have grayer colors, poor drainage and are formed on alluvial plains. The Sinheung soils have fine loamy textures and occur on broad alluvial plains. The Yongji soils have fine loamy textures and occur in granitic areas. The Jisan soils have grayer colors, poor drainage and occur in granitic and porphyry areas.

Setting: The Yuga soils occur in very gently sloping to sloping narrow valley alluvial plains in materials washed from gray shale soils. Dominant slopes are 2 to 7 percent and the range from 0 to 60 percent.

Principal Associated Soils: The Daegu, Mudeung, Jangweon and Sirye soils are associated with these soils in higher upland positions. The Honam and Hwadong soils are associated in river terrace positions. The Hogye and Banho soils occur on associated local alluvial fans.

Drainage and Permeability: Imperfectly drained. Permeability is slow. Runoff is slow or very slow as most areas are level terraced and dyked for paddy rice land use.

Use and Vegetation: Most areas of this soil are used for flood irrigated paddy rice and nonirrigated barley. Occasionally, small areas are used for vegetable crops.

Distribution and Extent: The Yuga soils are moderately extensive in most local alluvial valley positions in gray shale areas throughout the country.

Series Established: Dalseong Gun, Gyeongsangbug Do, 1967.

Lab. Nos. T221-226 Typifying Pedon

Depth cm	Horizon	Gravel >2mm	Particle Size Distribution 1/ (mm) % — U. S. Department of Agriculture: VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Textural Class	International: CS 2-.2	FS .2-.02	Silt .02-.002	Textural Class
0- 7	Ap1g	1.8	—	2.6	—	1.9	1.6	12.8	32.7	SiCL	3.0	15.9	48.4	SiC
7- 14	Ap2g	3.5	—	2.8	—	1.9	1.6	10.9	33.8	SiCL	3.2	14.0	49.0	SiC
14- 23	B1	1.8	—	1.8	—	1.4	1.9	11.5	33.9	SiCL	2.0	14.6	49.5	SiC
23- 50	B2	0.2	—	1.6	—	1.3	1.9	9.7	36.2	SiCL	1.8	12.7	49.3	SiC
50- 77	B3g	0.4	—	3.4	—	1.4	1.3	9.1	32.2	SiCL	3.7	11.5	52.6	SiC
77-150	Cg	1.7	—	6.9	—	1.9	2.1	15.8	26.0	SiL	7.4	19.3	47.3	SiC

Moisture Retention %: 1/10 atms	1/3 atms	15 atms	Bulk Density g/cc	pH: H_2O (1:1)	1 N KCl	O.M. %	2/ CEC	Extractable Cations me/100g: Ca	Mg	Na	K	H	Base Saturation %: CEC	Sum of Cations
	44.2	22.8	1.16	5.1	3.9	2.31	13.10	6.40	2.60	0.30	0.45	-	74.4	-
	39.8	26.4	1.16	5.9	4.9	2.02	12.60	8.20	2.30	0.25	0.33	-	87.9	-
	35.5	24.8	-	6.9	5.9	1.04	12.40	10.00	3.50	0.20	0.20	-	112.0	-
	33.2	19.2	1.48	7.2	6.1	0.77	12.20	9.80	3.10	0.23	0.15	-	108.9	-
	30.5	22.1	1.54	7.2	6.2	0.64	11.90	8.80	2.40	0.20	0.23	-	97.7	-
	29.8	14.5	-	7.3	6.0	0.77	10.00	7.30	1.50	0.18	0.20	-	91.8	-

Elemental Analysis of Clay: H_2O %	Igni. loss %	SiO_2/R_2O_3	SiO_2 %	Fe_2O_3 %	Al_2O_3 %	K_2O %
4.06	8.00	2.71	50.34	10.29	24.95	3.48
3.53	7.75	2.66	50.55	9.81	26.01	-
-	-	-	-	-	-	-
4.12	7.93	2.61	50.65	10.58	26.12	3.66
-	-	-	-	-	-	-
4.39	7.38	3.14	55.49	6.50	25.86	-

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Established Series
UKT, EDH, JFD
15 October, 1969

YUHA SERIES

The Yuha series is a member of the fine silty, mixed, mesic family of Typic Dystrochrepts (Lithosols). These soils have thin brown to dark brown silt loam A horizons and yellowish brown silt loam cambic B horizons with pinkish white, black and yellowish red mottles along the crack faces of residual rock structure. The C horizons are mottled pinkish white, black, and yellowish red silt loam very deep saprolite derived from andesite tuff.

Typifying Pedon: Yuha silt loam, eroded - barley and vegetables (Field description Gimhae Gun profile No. 71; colors are for moist soil.)

Ap -- 0 to 12 cm. Brown to dark brown (7.5YR 4/4) silt loam; weak fine and medium granular structure; friable, slightly sticky and slightly plastic; many fine living barley roots; abrupt smooth boundary; pH 7.5.

B -- 12 to 40 cm. Yellowish brown (10YR 5/4) silt loam; common fine distinct pinkish white (5YR 8/2) in mass mottles, few medium and coarse prominent black (5YR 2/1) and yellowish red (5YR 4/6) mottles along cracks; crushed color brown to yellowish brown (10YR 5/3-5/4); weak massive structure breaking to weak medium and fine subangular blocky; friable, sticky and plastic; gradual irregular boundary; pH 4.5.

C -- 40 to 110+cm. Mottled pinkish white, black, yellowish red and reddish brown silt loam deeply weathered saprolite in residual tuff; no evidence of clay movement; massive blocky rock structure with few round gravel pieces and cobbles.

Type Location: Gimhae Gun, Gyeongsangnam Do, top of hill behind Yuha Ri, (windmill village) Jucheon Myeon.

Range in Characteristics: A horizon thickness is commonly about 15 cm. ranging from 5 to 30 cm. Depth to hard bedrock ranges from 2 to 5 meters or more with occasional outcrops. Base saturation is mostly between 35 and 60 percent ranging to less than 35 percent. Less than 10 percent pebbles and cobbles occur in the solum and they have some tendency to concentrate at the surface probably because of erosion. Reaction is strongly acid to very strongly acid throughout the profile except where limed. The Ap or A horizons are brown to dark brown or dark reddish brown silt loam, light silty clay loam or the silty portion of clay loam. B horizons are yellowish brown or strong brown silt loam or light silty clay loam with weathered soil material mottles of yellowish red, reddish brown, pinkish white and yellow depending upon the nature of the parent materials. Few pieces of gravel and cobbles may occur. C horizons are dominantly yellowish brown, strong brown or yellow silt loam or light silty clay loam with varying amounts of white, black, yellowish red, reddish brown and mixed mineral grain colors. The saprolite is very thick, strongly weathered and more or less friable. The geology ground mass appears to be chiefly andesite porphyry, high in feldspar content, virtually void of mica and containing both occasional beds and random round gravel and cobbles. Angular fragments like those in breccia may also occur.

Competing Series and Their Differentiae: Related series are the Samgag, Sinjeong and Taehwa. The Samgag soils have coarse loamy textures and contain mica. The Sinjeong soils have gravelly fine loamy family textures. The Taehwa soils have gravelly fine loamy textures, argillic B horizons and andesite porphyry parent materials.

Setting: The Yuha soils occur on rolling to steep, hills and low mountains. Slopes are dominantly 15 to 30 percent and range from 7 to 60 percent. The Yuha soils are formed in residual deeply weathered tuff, andesite porphyry or related materials.

Principal Associated Soils: These are the Bonggye and Taehwa series. The Bonggye soils have red colors and argillic Bt horizons. The Taehwa soils are mostly on smoother slopes.

Drainage and Permeability: Well drained. Runoff is rapid and permeability is moderate.

Use and Vegetation: The sloping and moderately steep areas are used mainly for upland crops such as barley, soybean and mulberry; steep and very steep areas grow mostly pine forest, wild grass and some mixed shrubs.

Distribution and Extent: This series is of small extent. It occurs in scattered areas mainly in the south and southeastern parts of the country.

Series Established: Gimhae Gun, Gyeongsangnam Do, 1968.

Remarks: The moisture holding capacity is higher and the bulk density is lower than in most Korean soils.

Lab. Nos. G194-96 Typifying Pedon

Depth cm	Hori- zon	Gra- vel >2mm	Particle Size Distribution 1/ (mm) %											
			U. S. Department of Agriculture								International			
			VCS 2-1	CS 1-.5	MS .5-.25	FS .25-.10	VFS .10-.05	Silt .05-.002	Clay <.002	Tex- tural Class	CS 2-.2	FS .2-.02	Silt .02-.002	Tex- tural Class
0- 12	Ap	0.5	1.0	2.2	4.6	7.6	5.5	52.4	26.7	SiL	8.8	23.0	41.5	CL
12- 40	B	1.2		2.7		4.1	3.7	67.4	22.1	SiL	3.1	25.3	49.5	SiCL
40-110+	C	0.0		1.1		4.7	3.6	69.3	21.3	SiL	1.5	24.0	53.2	SiCL

Moisture Retention %			pH		O.M.	Avail.	2/	Extractable Cations					Base Saturation %	
1/10 atms	1/3 atms	15 atms	H_2O (1:1)	1 N KCl	%	P_2O_5 ppm	CEC	Ca	Mg	Na	K	H	CEC	Sum of Cations
							me/100g							
57.4	39.4	20.4	7.0	5.5	1.43	38	14.60	11.45	6.70	0.15	0.35	0.05	127.7	99.7
65.2	56.5	20.7	4.9	3.4	0.26	9	16.30	6.55	2.10	0.33	0.15	4.05	56.0	69.3
65.3	56.8	26.4	4.3	3.2	0.05	4	15.10	3.55	1.70	0.15	0.20	4.09	37.1	57.8

1/ Pipette Method, Sodium Hexameta-phosphate

2/ Ammonium Acetate Method

Appendix 1

PROJECT DOCUMENTATION, REPORTS AND PAPERS

Technical Report 1	The Soils of Korea (with map at scale 1:1 000 000)
Technical Report 2	Soil Reconnaissance of Korea (with map at scale 1:250 000)
Technical Report 3	Ulju Gun and Ulsan Si
Technical Report 4	Gimhae Gun
Technical Report 5	Dalseong Gun and Daegu Si
Technical Report 6	Gwangsan Gun, Damyang Gun, and Gwangju Si
Technical Report 7	Sangju Gun
Technical Report 8	Pyeongchang Gun
Technical Report 9	Gimje Gun
Technical Report 10	Buyeo Gun

The individual detailed Soil Survey Area Reports (Technical Reports 3-10) are each accompanied by a detailed soil map at scale 1:250 000. In addition the Korean Government is publishing a map at 1:50 000 scale with text in Korean. This map, made by aerial photo-interpretation with field checking at close intervals, is a highly detailed reconnaissance, in effect a semidetailed soil survey. From it the smaller reconnaissance map was generalized.

Research Papers

During the life of the project the laboratory staff prepared a number of reports of special investigations and research projects, as follows:

(1) Chemical and mineralogical properties of two low humic gley soils of Korea - Korean Journal of Soil Science and Fertilizers. Vol. I, pp.129-136.

(2) Evaluation of high and low productive paddy soils (in Korean). Office of Rural Development Annual Report, 1968.

(3) Field and laboratory evaluation of soils for improved orange and apple orchards (in Korean). Office of Rural Development Annual Report, 1968.

(4) Relationship between seed germination and soil moisture content in upland crops (in Korean). Office of Rural Development Annual Report, 1969.

(5) Field and laboratory evaluation of soils for better pastures (in Korean). Office of Rural Development Annual Report, 1969.

(6) Field and laboratory evaluation of soils suitable for mulberry cultivation (in Korean). Office of Rural Development Annual Report, 1969.

(7) Role of soil surveys in Urban and Regional Planning Report to the UNDP Technical Assistance Team.

(8) Forest soils of the Naktong River Basin; Report to the FAO Pre-investment Survey of the Naktong River Basin Project.

(9) Preliminary soil information for Whabong Irrigation Project; Report to the FAO Irrigation Project.

(10) Effect of different dispersion procedures on particle size fractionation; Special Investigation Report.

Appendix 2

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Appendix 3

GLOSSARY

Definitions given below are intended only to give the meaning of terms as they have been used in the Korea Soil Survey, and may be slightly at variance with definitions given for the same terms elsewhere.

Acidity. See reaction, soil.

Acid sulphate soil. A wet soil containing iron sulphates and iron carbonates, that is or becomes extremely acid when drained.

Albic horizon. A surface or lower horizon having such thin coatings on the sand and silt particles that the colour is primarily that of the mineral. Typical Albic horizons have colours of grey or light grey.

Alluvial. Consisting of or formed in material deposited by water.

Alluvium. Soil material that has been transported and deposited by water.

Argillic horizon. A horizon that has been enriched in clay. A diagnostic horizon used in the U.S.D.A. Soil Classification of 1965, amended in 1967.

Available moisture capacity. The capacity of a soil to hold water in a form available to plants. The amount of moisture held in a soil between field capacity, or about one third atmosphere of tension, and wilting point, or about 15 atmospheres of tension. Terms for available moisture capacity used in this report (determined to a depth of 125 cm) are the following: high - 25 cm more; medium - 15 to 25 cm ; low - 7 to 15 cm; and very low - less than 7 cm.

Azonal soil. Soils without well developed soil characteristics, owing to their youth, or to some condition of the parent material that prevents the development of normal soil profile characteristics.

Base saturation. The degree to which the base-exchange capacity of a soil is saturated with exchangeable cations other than hydrogen, and expressed as a percentage of the cation-exchange capacity. The terms used in this report are: high - 60 to 100 percent; medium - 35 to 60 percent; and low - less than 35 percent.

Cambic horizon. A soil horizon that has been changed or altered to some extent but which has not been enriched with clay. In Korea these horizons have soil structure rather than rock structure, reduction with mottles indicating movement of iron and other compounds, or the development of redder and more intense colours because of the weathering and oxidation of soil minerals.

Cation-exchange capacity. A measure of the total amount of exchangeable cations that can be held by a soil. It is expressed in terms of milliequivalents (me.) per 100 g of soil material that is neutral in reaction (pH 7.0). The terms used in this report are: high - 10 me. or more; medium - 6 to 10 me.; low - 3 to 6 me.; and very low - less than 3 me.

Clay. As a soil fraction, clay is defined as that fraction having mineral soil particles less than 0.002 mm in diameter. As a soil textural class, a clay soil is defined as material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A cutan composed of oriented clay particles.

Colluvial. Having been transported by gravity, mass slippage or a combination of slippage and local wash.

Colluvium. Soil material, rock fragments or both moved by creep, slide, or local wash and deposited at the base of a steep slope.

Complex (mapping unit). A mapped area which includes two or more distinct soil series.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose. Noncoherent; will not hold together in a mass.

Friable. When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm. When moist, crushed under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic. When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky. When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard. When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft. When dry, breaks into powder or individual grains under very slight pressure.

Continuum. The total soil landscape, consisting of areas that are representative of the several soils, together with areas between the soils that are not typical of a soil series, but which have some characteristics belonging to each of the adjacent series.

Correlation. The method by which the relationship of soils of different areas is shown and soils are named.

Cutan. A coating or film on the outside of a soil aggregate or mass. It may consist of clay, silt, oxides of iron or manganese, organic matter, or other materials.

Depth of soil. Thickness of soil over a specified layer, generally a layer that does not permit the growth of roots. Classes used in this soil survey to indicate depth are the following: deep - 1 m or more; moderately deep - 50 cm to 1 m; and shallow - less than 50 cm.

Detailed soil survey. A soil survey where the entire landscape is examined at close intervals and boundaries between soils are observed along their length. In Korea this kind of survey is done at a field scale of 1:10 000 or larger and is usually compiled at a scale of 1:25 000.

Diagnostic horizon. One of the kinds of soil horizons which are commonly used to identify and classify soils.

Dissection. The process of erosion whereby a land surface is cut by gullies, ravines, canyons, or large valleys.

Epipedon. The upper or surface horizon of soil.

Erosion. The washing of soil from the soil surface. It includes washing of a continuous thin layer from the surface, known as sheet erosion, as well as the formation of small valleys known as gully erosion.

Fabric (soil). The characteristic spatial arrangement of the soil particles and voids that form the soil mass.

Family (soil). A level of classification of closely related soils immediately above the series level. The soils of a family are usually very similar in their management characteristics.

Fluvio-marine. Deposited by joint action of streams and sea.

Fragipan. A dense and brittle pan, or layer, that owes its hardness mainly to extreme density or compactness rather than to content of much clay or cementation. Soil fragments that are removed are friable, but the material in place is so dense that roots cannot penetrate it and water moves through it very slowly by following vertical channels and cleavage planes.

Gley. A grey soil or soil horizon whose colour is the result of saturation of water. The process of formation of such a layer is gleying.

Great group. A grouping of soils below the suborder and above the subgroup, used in the 1965 U.S.D.A. Classification of soils.

Great soil group. A soil grouping described in the U.S.D.A. 1938 yearbook, Soils and Men.

Histic epipedon. A thin peaty surface horizon as defined in the U.S.D.A. soil classification system of 1965, and amended in 1967.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has characteristics distinct from the soil above or below.

Intrazonal soil. A soil with developed characteristics that reflect the dominating influence of some local factor of relief, parent material, or age over the normal effect of climate and vegetation.

Legend, soil. The list of mapping units that describes the soils or other areas mapped.

Ochric Epipedon. A pale or light coloured surface horizon, as defined in the U.S.D.A. soil classification system of 1965 and amended 1967.

Loam. (1) Soil containing a relatively even mixture of sand and silt and a somewhat smaller proportion of clay, generally a desirable proportion. May be subdivided into textural classes, such as sandy loam, loam, silt loam, and clay loam. (2) Specifically, soil material containing 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Mapping units. The units shown on soil maps. They may be mainly soil series, phases of soil series, complexes of soil series, or some other combination such as mixtures of soil series and rock outcrop.

Mollic epipedon. A thick dark-coloured surface horizon high in organic matter and having a high base saturation.

Paddy. A small field that has been levelled with a bund capable of retaining a shallow depth of water. Paddies are used principally for growing rice.

Permeability, soil. The quality of a soil that enables it to transmit air and water. The following relative classes of soil permeability, used in this soil survey, refer to estimated rates of movement of water in millimetres per hour through a saturated, undisturbed core under a 4 cm head of water: very slow - less than 1 mm; slow - 1 to 5 mm; moderately slow - 5 to 15 mm; moderate - 15 to 50 mm; moderately rapid - 50 to 150 mm; rapid - more than 150 mm.

pH. See soil reaction.

Profile. A vertical section of soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour", soil is one that gives an acid reaction; an alkaline soil is one with a pH above 7.0. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Midly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and high
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Reconnaissance survey. An extensive type of soil survey with actual observations of soils being made at intervals and soil boundaries estimated in areas not observed. In Korea reconnaissance maps are made at scales of 1:250 000 and 1:25 000.

Residuum. The material left after rock has weathered.

Sand. As a soil separate, individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 mm in diameter. Most sand grains consist of quartz, but sand may be of any mineral composition. As a textural class, soil material that is 85 percent or more sand and not more than 10 percent clay.

Sediment. Soil material that has been deposited by water.

Silt. As a soil fraction, individual mineral particles in a soil that ranges from the upper limit of clay (0.002 mm) in diameter to the lower limit of very fine sand (0.05 mm). As a textural class, soil material that is 80 percent or more silt and less than 12 percent clay.

Slope. Soil slope is measured by using a hand level and is expressed as the percent the vertical distance (change of elevation) is of the horizontal distance. Slope classes and terms used to describe them are as follows:

Slope Percent	Class	Mapping Symbol
0 - 2	Nearly level	A
2 - 7	Gently sloping	B
7 - 15	Sloping	C
15 - 30	Moderately steep	D
30 - 60	Steep	E
60 or more	Very steep	F

Soil colour. Soil colour is measured by the Munsell colour system. The U.S.D.A. Soil Survey Manual is the source of the names applied to the Munsell colours.

Soil drainage. The terms used for soil drainage are described in the U.S.D.A. Soil Survey Manual.

Soil genesis. The mode of origin of soil, referring particularly to the processes responsible for the development of distinguishing soil characteristics.

Soil management. The selection of crops, fertilizers and other amendments, and cultural practices to be used for the production of crops on a soil.

Soil morphology. The physical constitution of the soil including the texture, structure, porosity, consistence, and colour of the various soil horizons, their thickness, and their arrangement in the soil profile.

Soil phase. A subdivision of a classification unit of soil based upon slope, erosion, coarse fragments or other characteristics which have importance in use and management.

Soil series. The basic unit of soil classification. A collection of soil individuals essentially uniform in differentiating characteristics or in the arrangement of horizons or in the absence of horizons.

Soil texture. The relative proportion of the various size groups of individual soil grains. The classification is the one used by the U.S.D.A. and described in the Soil Survey Manual.

Soil type. A subdivision of soil series based upon the texture of the surface layer.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles.

Terrace. An alluvial plain that has elevation above the present floodplain.

Umbric epipedon. A thick dark-coloured surface horizon high in organic matter and having a low base saturation.

Water table. The upper limit of the part of the soil that is wholly saturated with water.

Zonal soil. A soil having well developed characteristics that reflect the influence of the active factors of soil genesis - climate and vegetation.

Appendix 4

GENERAL SOIL MAP

The general soil map, 1:1 000 000 scale, is a generalization from the soil reconnaissance of Korea, which was prepared at a scale of 1:250 000. The reconnaissance was carried out by aerial photo-interpretation, combined with field checking, and supported by laboratory analysis of representative soils. This work was completed during the first three years of the project life, and is scheduled for publication as Technical Report 2 of the project.

The main purpose of the general soil map is to provide an overall picture of the geographic distribution of the principal groups of soils of Korea. It represents also a contribution to the FAO/Unesco World Soils Map Programme, which is being conducted by the World Soils Resources Office of the FAO.

Being of small scale and highly generalized, this map can be used only to show the location of broad geographic areas. It is most useful for delineating geographic areas in which developmental studies may be made and for seeing relations among major soil areas of the country.

The map is made up of Great Soil Group associations and phases of associations. A summarized description of each mapping unit, together with a very general land capability classification, paddy suitability grouping and recommendations concerning management of the main soils is included.

The summarized descriptions are presented in tabular form. Seventeen items are listed. Of these, items 6 through 13 refer to characteristics of the dominant soil in the unit. The others refer to the unit as a whole. The dominant land capability classes and paddy suitability groups as defined in this report are given for each unit. Also, units which are mostly comprised of very steep, high, gullied, stony or rocky soils not now used for paddy are assigned to paddy suitability group 5. Soils in these units are generally unsuited to paddy and are not placed in a paddy suitability group in detailed survey interpretations.

LEGEND

A. Coastal and Inland Alluvial Plains

A1 Low-Humic Gley and Alluvial Soils, Fluvio-Marine Phase.

A2 Alluvial and Low-Humic Gley Soils, Continental Phase.

B. Rolling Pediplanes and Older Terraces

B1 Red-Yellow Podzolic Soils.

B2 Red-Yellow Podzolic Soils and Lithosols.

B3 Red-Yellow Podzolic Soils with high base status, Calcareous and Mafic Materials.

B4 Andosols and Lithosols.

C. Strongly Dissected Hilly and Mountainous Lands

C1 Red-Yellow Podzolic Soils and Regosols, Siliceous Materials.

C2 Red-Yellow Podzolic Soils with high base status and Lithosols, Calcareous Materials.

C3 Lithosols, and Regosols Weakly Developed Soils Micaceous and Hard Siliceous Materials.

C4 Lithosols, with some Red-Yellow Podzolic Soils of high base status, Sedimentary (Argillic-Arenaceous) Materials.

C5 Lithosols, and Red-Yellow Podzolic Soils, Siliceomafic Materials.

D. High Mountains and Plateau Remnants

D1 Acid Brown Forest Soils.

D2 Lithosolic Soils, and Acid Brown Forest Soils.

SUMMARY DESCRIPTIONS OF THE MAPPING UNITS

A. Soils of the Coastal and Inland Alluvial Plains

Mapping Unit - A1	:	Low-Humic Gley and Alluvial Soils, Fluvio-Marine Phase.
1. Occurrence	:	In relatively extensive areas in the west coast, particularly south of the Geum River mouth, in the Han and Nagdong Rivers and in areas near Pyeongtaeg. On the east coast this unit is in small areas.
2. Climate	:	Dominantly "warm temperate rainy climate with winter dry season with hot humid summers"; the mean annual rainfall ranges from 1 000 to 1 200 mm.
3. Physiography	:	Recent broad and flat estuarine and marine plains.
4. Geology and Parent Material	:	Holocene, dominantly silty and clayey deposits.
5. Vegetation and Use	:	Extensive and intensively used for many years as rice paddy and in particular areas in rotation with barley.
6. Colour and Texture	:	Dark greyish brown to dark grey silty clay surface over grey silty clay and occasionally loam substrata.
7. Depth	:	From 60 cm to more than 1 m to coarse textures.
8. Drainage	:	Varies from poorly to imperfectly drained.
9. Structure	:	Subangular blocky or massive.
10. Organic Matter	:	Relatively low, in certain backswamp areas may be higher.
11. Reaction	:	Acid to neutral in the surface; usually alkaline in the substrata.
12. Erosion	:	None.
13. Base Saturation and Plant Nutrients	:	Commonly medium to high, medium to high content of plant nutrients.
14. Productivity	:	Soils of relatively high to medium productivity.
15. Limitations	:	Lack of drainage and occasionally salinity, near the coast and toxicity due to acid sulphate in a few places.
16. Land Capability Class	:	II, III.

17. Paddy Suitability Group	:	P1, P2

<u>Mapping Unit</u> - A2	:	Alluvial and Low-Humic Gley Soils, Continental Phase.
1. Occurrence	:	With exception of the central and northeastern mountainous regions, this unit occurs irregularly distributed along the main rivers of Korea as well as in isolated areas related to local base levels. The most extensive areas are located in the lower Nagdong and Han Rivers.
2. Climate	:	Under all the main kinds of climates of Korea.
3. Physiography	:	Extensive inland broad nearly level alluvial plains often related with local base levels.
4. Geology and Parent Material	:	Holocene, recent and subrecent silty, clayey and sandy alluvial deposits.
5. Vegetation and Use	:	Dominantly cultivated land. The dominant crop is rice in paddy; sometimes in rotation with barley. Small areas of nonirrigated crops are grown.
6. Colour and Texture	:	Grey to dark greyish brown mottled sandy loam to clay loam surfaces over dominantly grey to dark yellowish brown or sometimes yellowish red subsoils with mottles and often manganese concretions.
7. Depth	:	More than 1 m.
8. Drainage	:	Dominantly poorly to imperfectly drained; sometimes well drained.
9. Structure	:	Subangular blocky, sometimes structureless.
10. Organic Matter	:	Low with some exceptions.
11. Reaction	:	Strongly acid to slightly acid.
12. Erosion	:	None. Some parts are subject to flooding and siltation.
13. Base Saturation and Plant Nutrients	:	Medium to high except for sandy soils which are low.
14. Productivity	:	The productivity of these soils depends very much on their management and on the availability of irrigation water. Under good management, they are highly productive soils.
15. Limitations	:	Drainage, availability of water and sometimes water holding capacity are the major limitations.

16.	Land Capability Class	:	II, III, IV, with some I
17.	Paddy Suitability Group	:	P1, P2, P3, with some P4

B. Rolling Pediplanes and Older Terraces

Mapping Unit - B1 : Red-Yellow Podzolic Soils.

1.	Occurrence	:	Extensive areas in the west coastal region from the D.M.Z. to the extreme south of Jeonlanam Do and penetrating inland along the main valleys up to Daejeon and Gwangju; scattered small areas throughout Korea.
2.	Climate	:	"Warm temperate climate with hot humid summers and cool dry winter"; rainfall ranges between 100 mm and 1 300 mm.
3.	Physiography	:	Strongly dissected pediplanes and correlated pediments, rolling to undulating relief.
4.	Geology and Parent Material	:	Thin older fluvial pedimentary material overlying deeply weathered precambrean granites, gneisses and schists.
5.	Vegetation and Use	:	When not cultivated, dominantly conifers with deciduous shrubs and grasses. Most of the land is under upland cultivation.
6.	Colour and Texture	:	Yellowish brown to red loam surfaces over yellowish red to red clay and loam subsoils over sandy deeply weathered bedrock.
7.	Depth	:	Moderate from approx. 50 cm to more than 1 m.
8.	Drainage	:	Well drained.
9.	Structure	:	Subangular blocky, sometimes weakly developed.
10.	Organic Matter	:	Very low.
11.	Reaction	:	Acid.
12.	Erosion	:	Moderate to slight.
13.	Base Saturation and Plant Nutrients	:	Relatively low and poor in plant nutrients.
14.	Productivity	:	These soils are able to produce moderate to relatively high yields of upland crops when properly cultivated.

15. Limitations	:	Low fertility status, low organic matter content, erosion and lack of irrigation water are the major limitations.
16. Land Capability Class	:	III, IV, with some II, VI and VII.
17. Paddy Suitability Group	:	P3, P4.

<u>Mapping Unit</u> - B2 : Red-Yellow Podzolic Soils and Lithosols.

1. Occurrence	:	Scattered inland areas north of Daejeon around Chuncheon, and in the vicinity of Gangneung.
2. Climate	:	Under the main kinds of climates of Korea.
3. Physiography	:	Strongly dissected, denudated and recently eroded rolling pediplanes with gullies.
4. Geology and Parent Material	:	Deeply weathered acidic crystalline rocks, mostly granite and moderately weathered sedimentary materials with small scattered thin alluvial pedimentary material remnants.
5. Vegetation and Use	:	Sparse cover of pine trees, shrubs and grasses. Only scattered small areas are cultivated.
6. Colour and Texture	:	Greyish brown sandy to loamy surface over yellowish brown to pale brown sandy substrata.
7. Depth	:	Shallow soils, generally less than 30 cm.
8. Drainage	:	Well to excessively drained.
9. Structure	:	Structureless or weak subangular blocky.
10. Organic Matter	:	Very low.
11. Reaction	:	Acid.
12. Erosion	:	Severe, with many gullies.
13. Base Saturation and Plant Nutrients	:	Low and poor in nutrients.
14. Productivity	:	Poor soils not well suited for agriculture.
15. Limitations	:	Erosion, water holding capacity, and low fertility status are the major limitations.
16. Land Capability Class	:	Upland - III to VII.
17. Paddy Suitability Group	:	P3, P4, P5.

Mapping Unit - B3	:	Red Yellow Podzolic Soils with high base status, Calcareous and Mafic Materials.
1. Occurrence	:	In Gangweon Do, southwest of Gangneung, as relatively small areas; in the headwater valleys of the Han River and tributaries, Taebaegsan region; along the Imjin River; and in scattered areas, in the extreme south.
2. Climate	:	"Cool-snow forest climate" to "warm rainy temperate climate with hot humid summers and cool dry winters"; annual rainfall between 1 000 and 1 100 mm.
3. Physiography	:	Moderate to strong dissected rolling pediplanes, pediment slopes and terraces.
4. Geology and Parent Material	:	Thin alluvial pedimentary material covering Cambro-Ordovician limestone and related rocks associated with schist, including also basalt and siliceomafic rocks (andesite-porphyries, etc.)
5. Vegetation and Use	:	Conifers, deciduous trees and shrubs. Some other areas are used for upland crops.
6. Colour and Texture	:	Dark greyish brown to dark brown clay loams to clay over red to reddish brown clay subsoils.
7. Depth	:	Generally between 50 cm to more than 1 m.
8. Drainage	:	Well drained.
9. Structure	:	Strongly subangular blocky and prismatic.
10. Organic Matter	:	Relatively low.
11. Reaction	:	Slightly to moderately acid, pH commonly above 6.
12. Erosion	:	Moderate.
13. Base Saturation and Plant Nutrients	:	Medium to high; soils relatively high in calcium and magnesium.
14. Productivity	:	These soils are highly productive.
15. Limitations	:	Lack of water for irrigation, deficiency of organic matter and potassium, and erosion are the major limitations.
16. Land Capability Class	:	III and IV, with some VI and VII.
17. Paddy Suitability Group	:	P3, P4.

Mapping Unit - B4 : Andosols, and Lithosols.

1.	Occurrence	: In Jeju Do, isolated island, about 90 km south of the continental land.
2.	Climate	: "Warm temperate rainy climate without dry season with hot summers". Jeju Do has a distinct climate with the mean annual temperature of 15°C and the mean monthly minimum temperature above the frost point; the annual rainfall is nearly 1 500 mm.
3.	Physiography	: A type of insular volcano, elliptically elongated east to west. Foot slopes of the main volcano are very gentle with nearly level broad undulating to rolling relief.
4.	Geology and Parent Material	: Tertiary volcanic rocks and ash such as basaltic lava, trachyte and andesites.
5.	Vegetation	: Grasses and shrubs, with deciduous and coniferous trees growing on the intermountainous areas. Upland crops are cultivated intensively in coastal areas.
6.	Colour and Textures	: Dark brown to black loam to silty clay surfaces over brown to dark reddish brown clay loam to clay subsoils.
7.	Depth	: Shallow to deep.
8.	Drainage	: Well to excessively drained.
9.	Structure	: Granular to subangular blocky and massive.
10.	Organic Matter	: Relatively high.
11.	Reaction	: Acid.
12.	Erosion	: Moderate; wind erosion is a problem.
13.	Base Saturation and Plant Nutrients	: Medium to low.
14.	Productivity	: Low to moderately high.
15.	Limitations	: Stoniness, wind erosion and phosphate deficiency are the major limitations.
16.	Land Capability Class	: II to VI.
17.	Paddy Suitability Group	: P4, P5.

C. Strongly Dissected Hilly and Mountainous Lands

Mapping Unit - C1	:	Red-Yellow Podzolic Soils and Regosols, Siliceous Materials.
1. Occurrence	:	Extensively throughout Korea from the D.M.Z. to the extreme south, with the exception of southeastern Gyeongsangnam Do, where scattered areas occur.
2. Climate	:	"Warm temperate climate with hot summers and dry winters" in the south, to "cool snow-forest climate" in the northern regions; rainfall ranges from 1 000 mm to 1 300 mm.
3. Physiography	:	Strongly dissected mountainous land with young narrow valleys and swales inserted; altitudes are generally above 300 m up to more than 1 000 m.
4. Geology and Parent Material	:	Precambrean and supposedly younger rocks, including mainly migmatites (granite-gneiss), granites and several kinds of crystalline schists, slightly to exceptionally strongly weathered.
5. Vegetation and Use	:	Variable, from shrubs, grasses and deciduous forest in the south to somewhat dense coniferous and deciduous forest in the northeastern region. Cultivation limited to valleys and gentle foot slopes. Shifting cultivation on steep slopes in the northeast.
6. Colour and Texture	:	Brown to greyish brown coarse and medium textured surface over greyish brown, to strong brown medium and coarse textured substrata or hard bedrock. Limited areas with developed subsoils occur.
7. Depth	:	Relatively shallow, ranging from 30 cm.
8. Drainage	:	Excessively to well drained.
9. Structure	:	Structureless in the undeveloped soils to weakly subangular blocky in the developed soils.
10. Organic Matter	:	Ranging from very low to moderate.
11. Reaction	:	Acid.
12. Erosion	:	Moderate to severe.
13. Base Saturation and Plant Nutrients	:	Relatively low and poor in plant nutrients.
14. Productivity	:	Low for agriculture. Low to high for forestry.
15. Limitations	:	This mapping unit presents strong limitations for agricultural use due to the steep slopes and shallow soils; the workability is difficult.

16.	Land Capability Class	:	VI and VII, limited areas of IV.
17.	Paddy Suitability Group	:	P4, P5.

Mapping Unit - C2 : Red-Yellow Podzolic Soils with high base status and Lithosols, Calcareous Materials.

1.	Occurrence	:	In the central northeastern region, in the vicinity of Taebaegsan and in other very small scattered areas.
2.	Climate	:	"Cool-snow forest climate with hot (to mild) summers and dry winters"; annual rainfall varies from 1 100 to 1 200 mm.
3.	Physiography	:	Strongly dissected mountainous land, including few dissected remnants of older erosion levels or plateaus; karst relief appears in certain areas.
4.	Geology and Parent Material	:	Cambo-Ordovician, limestones and related rocks, associated with schists, coal and metasediments.
5.	Vegetations and Use	:	Mostly forest composed of pine, deciduous trees and shrubs. Some valley and foot slope lands are cultivated. Shifting cultivation is destroying the forest in places.
6.	Colour and Texture	:	Variable, dominantly brown to dark reddish brown gravelly loam to silty clay surface over reddish brown to red clayey or silty clayey gravelly subsoils where developed; otherwise over variably weathered rock.
7.	Depth	:	Dominantly less than 50 cm with the exception of the plateaus where relatively deep soils occur (more than 1 m).
8.	Drainage	:	Well to excessively drained.
9.	Structure	:	Structureless to weak subangular blocky.
10.	Organic Matter	:	Low to medium, rarely high.
11.	Reaction	:	Slightly acid to neutral.
12.	Erosion	:	Strong to severe.
13.	Base Saturation and Plant Nutrients	:	Medium to high; these soils are relatively high in calcium and magnesium.
14.	Productivity	:	Medium to high for forest.
15.	Limitations	:	Erosion, shallowness and workability in the mountainous areas are the major limitations.

16. Land Capability Class	:	VI and VII; limited areas classes III and IV.
17. Paddy Suitability Group	:	P5.

Mapping Unit - C3 : Lithosols, and Regosols, Weakly Developed Soils, Micaceous and Hard Siliceous Materials.

1. Occurrence	:	Dominantly in the central region, also in the north-east, and in scattered areas in the northwest.
2. Climate	:	Under the main climates of Korea; however dominantly under "cool-snow forest climate with hot summers and dry winters"; the average rainfall ranges between 1 100 to 1 200 mm; the winter begins early in these areas.
3. Physiography	:	Strongly dissected mountainous and hilly lands with asymmetric slopes following the dip and strike of the rock; rocky land often appears on the steepest slopes and highest elevations.
4. Geology and Parent Material	:	Precambrean to Jurassic crystalline schists and hard metamorphic sediments; including mica schist, quartzites, phyllite, slate, arkose, etc.
5. Vegetation and Use	:	Dominantly pine and deciduous trees with shrubs and grasses in cutever areas. Cultivation is very limited.
6. Colour and Texture	:	Variable, according to the nature of the parent materials; dominantly greyish brown or brown rocky coarse loamy surfaces over variably weathered bed-rock. The amount of mica is commonly high.
7. Depth	:	Relatively shallow soils.
8. Drainage	:	Excessively drained.
9. Structure	:	Structureless or weakly developed.
10. Organic Matter	:	Low with the exception of some soils at higher altitudes.
11. Reaction	:	Acid.
12. Erosion	:	Slight to severe.
13. Base Saturation and Plant Nutrients	:	Relatively low to medium; poor to moderate in plant nutrients.
14. Productivity	:	Medium to high for forest.
15. Limitations	:	Shallowness, low fertility status, and severe erosion hazard are the major limitations.

16. Land Capability Class : VI and VII, limited areas III and IV.

17. Paddy Suitability Group : P5.

<u>Mapping Unit</u> - C4 : Lithosols, with some Red-Yellow Podzolic Soils with medium base status, Sedimentary (Argillic-Aranaceous) Materials.

1. Occurrence : Restricted to the sedimentary geological formations covering large areas in the southwestern regions of the Gyeongsang Do provinces and isolated areas in the southwest and central regions, Jeonla Do province.

2. Climate : "Warm temperate rainy climate with hot summers and dry winters". The rainfall ranges between 900 mm to 1 300 mm. A minimum precipitation occurs in the inland areas.

3. Physiography : Strongly dissected and denudated hilly and mountainous land with rounded hills, semiconvex slopes and very rarely tableland remnants.

4. Geology and Parent Material : Jurassic to Cretaceous sediments and semimetamorphic rocks, comprising hard shale, sandstone, conglomerate, arkose, etc.

5. Vegetation and Use : Dominantly grasses and shrubs with some few areas under forest in the highest elevations. Cultivation is limited to valleys and lower slopes.

6. Colour and Texture : Brown loamy surfaces ever greyish brown to strong . brown loamy to clayey variably weathered substrata.

7. Depth : Mostly very shallow soils.

8. Drainage : Excessively drained.

9. Structure : Dominantly subangular blocky to mostly structureless.

10. Organic Matter : Low to moderate in the highest elevations.

11. Reaction : Acid.

12. Erosion : Strong to severe

13. Base Saturation and Plant Nutrients : Medium to poor in plant nutrients.

14. Productivity : Low.

15. Limitations : Shallowness, low fertility status and erosion hazard are the major limitations.

16. Land Capability Class : VI and VIII, limited areas III and IV.

17. Paddy Suitability Group	:	P5.

Mapping Unit - C5	:	Lithosols and Red-Yellow Podzolic Soils, Siliceomafic Materials.
1. Occurrence	:	Dominantly in the southern and central regions as isolated small areas, and as a single large area in the Imjin River basin north of Seoul.
2. Climate	:	Dominantly under warm temperate rainy climate with, or without, dry season and part under cool snow-forest climate with hot summers and dry winters; the rainfall ranges from 900 mm to 1 300 mm.
3. Physiography	:	Strongly dissected mountainous land with subconvex slopes and, in some areas, a domeform with radial drainage pattern.
4. Geology and Parent Material	:	Cretaceous to Tertiary siliceomafic materials derived from andesite-porphyries, trachyte, dacite gabbro and basalts.
5. Vegetation and Use	:	Grasses and shrubs with pine and deciduous forest. Many bottom slopes and valleys are cultivated.
6. Colour and Texture	:	Light brown to dark brown loamy surfaces over strong brown to dark red fine loamy to clayey subsoils or variably weathered bedrock.
7. Depth	:	Mostly very shallow, relatively deep on some lower slopes.
8. Drainage	:	Well to excessively drained.
9. Structure	:	Structureless to subangular blocky.
10. Organic Matter	:	Relatively low.
11. Reaction	:	Acid.
12. Erosion	:	Slight to severe.
13. Base Saturation and Plant Nutrients	:	Medium to low with moderate plant nutrient content.
14. Productivity	:	Low to high for forest.
15. Limitations	:	Shallowness, low fertility status and erosion hazard are the main limitations.
16. Land Capability Class	:	VI and VII, limited areas III and IV.
17. Paddy Suitability Group	:	P5.

D. High Mountains and Plateau Remnants

Mapping Unit - D1	:	Acid Brown Forest Soils.
1. Occurrence	:	In relatively small areas restricted to the north-eastern mountainous region in the vicinity of Gangneung; this mapping unit also occurs in scattered areas too small to map in the south.
2. Climate	:	Cool-snow forest climate with an annual rainfall of 1 000 to 1 200 mm; the frost in this region begins early.
3. Physiography	:	Dissected plateau remnants or older erosion surfaces. above 500 m, with rolling to hilly local relief.
4. Geology and Parent Materials	:	Dominantly Precambrean, granites and gneisses.
5. Vegetation and Use	:	Shrubs, grasses, conifer and deciduous forests. Considerable land is cultivated.
6. Colour and Texture	:	Thick very dark brown loamy surfaces over dark to strong brown silt loam and clay loam subsoils.
7. Depth	:	Relatively deep soils reaching sometimes more than 150 cm.
8. Drainage	:	Well drained.
9. Structure	:	Granular to weakly developed subangular blocky.
10. Organic Matter	:	High to moderate.
11. Reaction	:	Acid to very acid.
12. Erosion	:	Slight to strong.
13. Base Saturation and Plant Nutrients	:	Relatively low and poor in plant nutrients.
14. Productivity	:	High for forest. Areas not too steep can produce high yields of several upland crops with proper management and complete fertilizers.
15. Limitations	:	Low fertility status, erosion hazard and short growing period due to frost are the major limitations.
16. Land Capability Class	:	Mostly VI and VII with some IV.
17. Paddy Suitability Group	:	P5.

Mapping Unit - D2	:	Lithosolic Soils and Acid Brown Forest Soils.
1. Occurrence	:	Extensive areas in the northeastern mountainous region and scattered areas of high altitudes in the south.
2. Climate	:	Dominantly under "cool-snow forest climate", with an average of 1 000 to 1 200 mm of annual rainfall; the frost begins early and the snow lasts for a long period.
3. Physiography	:	Strongly dissected mountains, mainly above 500 m, including elevated valley systems.
4. Geology and Parent Material	:	Precambrean, dominantly granites and gneisses.
5. Vegetation and Use	:	Forest on the slopes, changing sometimes to shrubs and grasses at the top. Cultivation is very limited.
6. Colour and Texture	:	Dark brown loamy surfaces over dark to strong brown and light brown loamy to sandy subsoils or bedrock.
7. Depth	:	Shallow on the mountainous slopes becoming deeper on foot slopes and in valleys.
8. Drainage	:	Well to excessively drained.
9. Structure	:	Friable, structureless to weak subangular.
10. Organic Matter	:	Relatively high.
11. Reaction	:	Acid to very acid.
12. Erosion	:	Slight to severe.
13. Base Saturation and Plant Nutrients	:	Low and poor in plant nutrients.
14. Productivity	:	Moderately high to high for forest and grass.
15. Limitations	:	Low fertility status, erosion, shallowness and difficult workability are the major limitations.
16. Land Capability Class	:	VI, VII.
17. Paddy Suitability Group	:	P5.

LAND USE RECOMMENDATIONS AND DEVELOPMENT POSSIBILITIES

A. Soils of the Coastal and Inland Alluvial Plains

Mapping Unit - A1 : Low-Humic Gley and Alluvial Soils, Fluvio-Marine Phase

Soils of this unit are considered the most suitable in Korea for intensive agriculture development.

Most of this land is used for paddy and is chiefly in paddy suitability groups P1 and P2. In most places it is single cropped with rice. However, in the Gyeongsang Do and Jeonla Do areas, it is often cultivated in a rotation system with rice and barley, because of the longer growing season in this region.

These soils are recommended for paddy, because of their depth, nutrient and water holding capacity. Recommended soil management practices include deep ploughing, early season culture and the mixing of the nitrogen into the soil when applied. On coarse textured Alluvial soils, the spraying of urea on the foliage and the use of silicate fertilizers and iron enriched compost are recommended, because soil permeability is relatively rapid and nutrient holding capacity is low.

Some Saline Alluvial Soils, along the coast are included in this unit, and these soils have sufficient salts to affect the yields. They should be leached by proper continuous irrigation with fresh water. Selection of salt tolerant rice varieties (Gimma Jae, Iri 278), close spacing (increasing the number of hills per unit area), and high levels of fertilization also are recommended.

Development possibilities: Although these soils are used intensively now, there are many places where improved drainage would permit more double cropping, of rice followed by barley, and a wider choice of possible crops in both summer and winter.

Mapping Unit - A2 : Low-Humic Gley and Alluvial Soils, Continental Phase

Soils of this unit are among the most suitable in Korea for intensive agriculture development along with those of unit A1.

Most of this land is used for paddy fields and is chiefly in paddy suitability groups P1, P2 and P3. In most of the country they are single cropped to rice, but in the Gyeongsang Do and Jeonla Do areas a rotation system of rice and barley is commonly used. It is also possible to introduce a rotation system with rice and rye for green manure, flax and autumn potatoes in the middle and northern parts of Korea.

Recommended soil management practices include deep ploughing, early season culture and the mixing of nitrogen into the soil when applied.

Alkiochi pehomenon (failure to make good seed head) on rice growing frequently occurs on coarse textured Alluvial soils. To correct this the spraying of urea on the foliage, use of silicate fertilizers and iron enriched compost, and light split applications of nitrogen and potash are recommended.

Development possibilities: The favourable soils are now in paddy rice, but the extent could be increased if additional water were provided. The areas in orchards and vegetable crops can be increased considerably.

B. Soils of the Rolling Pediplanes and Older Terraces

Mapping Unit - B1 : Red-Yellow Podzolic Soils

The soils of this unit are among the more suitable in Korea for intensive agricultural development. Much of this land is used for nonirrigated upland crops.

The soils of this unit are recommended for a wide variety of crops, because of their sufficient depth, fine texture, fairly good workability and moderate slopes.

Barley, soybeans, wheat, sweet potatoes, fruit crops and vegetables are the principal crops. Recommended soil management practices include liming, and the use of compost and fertilizers, especially nitrogen and phosphate. This is because of the acidity, low organic matter content and low natural fertility. Soil conservation practices such as contour cultivation, terracing and protection of the water ways are needed to counteract the hazards of erosion and runoff.

Development possibilities: Part of this area is suited for rice paddy if water is provided. The greater part is suitable for nonirrigated cultivated crops such as barley, wheat, soybeans, sweet potatoes; and for pasture, orchards, vineyards and mulberry. Soils in this area offer excellent opportunity for development by converting from woodland of low productivity to these uses.

Included in this unit is a considerable amount of steep and/or severely eroded land in capability classes VI and VII which should be used for forest or other perennial vegetation.

Mapping Unit - B2 : Red-Yellow Podzolic Soils and Lithosols

Soils of this unit vary widely in suitability for use. Some but not all, are suitable for intensive agricultural development. The land is now used for nonirrigated upland crops, orchards, pasture and forestry. Some areas of land in the narrow valleys are well suited to paddy and are used for rice if water is available.

Soil conservation practices such as bench terracing and protection of water ways are needed to counteract the hazards of erosion and runoff. The most effective way of erosion control on eroded areas is mixed seeding of grasses with legumes. The bench terracing method is recommended for cropland where it can be used. Mulberry field formation and sometimes orchards are recommended.

When cultivated, good soil management practices including liming and the use of compost and fertilizers, especially nitrogen and phosphate, are recommended.

Development possibilities: There is good opportunity for development of pasture land and commercial orchards in these areas. Some areas of woodland could be converted to more intensive uses, and large areas of woodland which are now producing little could be made more productive by improved management.

Mapping Unit - B3 : Red-Yellow Podzolic Soils, with high base status

Soils of this unit are among the more suitable in Korea for intensive agricultural development. Much of this land is now being used for upland crops. The soils of this unit are recommended for upland crops, because of their suitable slopes, sufficient depth, fine texture, high base saturation and fairly good workability. Barley, soybeans, wheat, sweet potatoes and other annuals are the principal crops.

Recommended soil management practices include the use of compost and fertilization, expecially with nitrogen and phosphate, because although these soils are weakly acid to neutral, and have a high content of exchangeable cations, they are still low in organic matter and phosphate.

Soil conservation practices such as contour cultivation, terracing and protection of water ways are needed to counteract the hazards of erosion and runoff.

Development possibilities: There is very good opportunity in these areas for development by converting from woodland to pasture and nonirrigated cultivated crops, as well as in improved management of woodland.

Mapping Unit - B4 : Andosols and Lithosols (Jeju Do Volcanic Island)

Soils of this unit are suitable for intensive agricultural development but lack of sufficient water for irrigation imposes some limitations. Much of this land is used for nonirrigated crops and pasture.

In most places the soils are suitable for upland cultivation because they have high content of organic matter, sufficient depth, fine texture and fairly good workability. However, some areas which have steep slopes, stoniness, shallowness and only fair workability are not recommended for cultivation but can be used for pasture.

Barley, soybeans, wheat, sweet potatoes and onions are the principal crops. Because of the acidity, low base saturation and phosphate deficiency recommended soil management practices include liming and fertilization, especially with phosphate fertilizers.

Wind erosion is a hazard and measures to counteract it are recommended. Plant nematodes also cause damage on these soils and control measures should be used.

Development possibilities: There are large areas which are suitable for grazing and could be developed for pasture. The nonirrigated cultivated crops can also be increased greatly.

C. Soils of the Strongly Dissected Hilly and Mountainous Lands

Mapping Unit - C1 : Red-Yellow Podzolic Soils and Regosols, Siliceous Materials

Soils of this unit are better suited to intensive forest than to agricultural development. Most of this land is used for forest and is chiefly in capability classes VI and VII.

These soils are recommended for forest, because they have steep slopes, are shallow and have poor workability. The soils are acid and of relatively low base saturation. Commercial timber production on this land is moderately good. Erosion control is the most important management consideration in the use of this land.

Development possibilities: These areas are now largely in woodland and development possibilities are mostly limited to improved production from forest. Scattered areas in valleys and foot slopes are suitable for nonirrigated crops, and in places paddy cultivation.

Mapping Unit - C2 : Red-Yellow Podzolic Soils with high base status and Lithosols, Calcareous Materials

Most of this land is used for forest and is chiefly in capability classes VI and VII. The soils are recommended principally for forest and in some areas pasture, because they have steep slopes, are shallow and have poor workability. They are weakly acid to neutral and have relatively high base saturation. Commercial timber production on this land is good. Erosion control is the most important management practice to be considered in the use of this land.

Scattered areas which are located on mountain foot slopes and in narrow valleys are recommended for cultivated crops and sometimes for paddy rice. These areas are chiefly in capability classes III and IV.

Development possibilities: These areas are now mostly in woodland. There is very good opportunity for improved production from forest, and some pasture development.

Mapping Unit - C3 : Lithosols and Regosols, Weakly Developed Soils, Micaceous and Hard Siliceous Materials

Most of this land is used for forest and is chiefly in capability classes VI and VII.

The soils are recommended principally for forest, because of steep slopes, shallowness and poor workability. Commercial timber production on this land is fairly good. These soils are generally shallower than those of the C1 and C2 units. Erosion control is the most important management practice to be considered in the use of this land.

Small areas on mountain foot slopes and narrow valleys are recommended for cultivation and in places for paddy rice. These areas are chiefly in capability classes III and IV.

Development possibilities: Opportunity for development in these areas is mostly in improved production from forest by intensive forest management.

Mapping Unit - C4 : Lithosols, Weakly Developed Soils and Rock Outcrop, Sedimentary (Argillic-Arenaceous) Materials

Soils of this unit are mostly considered not to be suitable for cultivation. Most of this land is now used for forest, is chiefly in capability classes VI, VII.

They are not recommended for cultivation because they have steep slopes, are shallow and have poor workability. Commercial timber production on this land is only fairly good, because of the slow permeability of the soils. Erosion control is the most important management practice to be considered in the use of this land.

Small areas on mountain foot slopes and in narrow valleys are recommended for cultivation and in places for paddy rice. These areas are chiefly in capability classes III and IV.

Development possibilities: Soils in this unit, which are mostly in poor quality woodland or brush land, are capable of producing fairly good forest; and some areas offer opportunities to develop improved pasture.

Mapping Unit - C5 : Lithosols, and Red-Yellow Podzolic Soils, Siliceomafic Materials

Soils of this unit are suitable for intensive forest development. Commercial timber production on this land is good. Most of this land is used for forest and is in capability classes VI and VII.

The soils are not recommended for cultivation, because they have steep slopes, are shallow and have poor workability. The soils have weakly acid to neutral reaction and higher base saturation than soils of the C1 unit. Erosion control is the most important management practice to be considered in the use of this land.

Small areas on mountain foot slopes and local valleys are recommended for cultivation and in some places paddy rice. These areas are chiefly in capability classes III and IV.

Development possibilities: Soils in this unit are now nearly all in woodland. There is good opportunity for increased forest production if improved management is used.

D. High Mountains and Plateau Remnants

Mapping Unit - D1 : Acid Brown Forest Soils

This unit includes the soils which have been called "Alpine", of which part are suitable for intensive agricultural development. These soils are recommended for upland cultivation, because they have high content of organic matter, sufficient depth, moderately fine textures, good workability, and slopes which permit some cultivation. Perhaps 20 percent of the land of this mapping unit has soils of this kind.

These soils are now being developed for agricultural use. Potatoes, corn, hops and radishes are the principal crops. Recommended soil management practices include liming and fertilization with complete fertilizers. Soil conservation practices, such as contour cultivation and terracing are needed to counteract the hazards of erosion and runoff.

The remaining 80 percent of the land in this unit belongs to capability classes VI and VII because of steepness, stoniness, shallow soils or other factors. These, however, are lands well suited to forestry, being lands similar to those of the D2 unit.

Development possibilities: There is good opportunity for further development of nonirrigated cultivated crops and for pasture. Forest production could be increased by improved management.

Mapping Unit - D2 : Lithosols, and Acid Brown Forest Soils

Soils of this unit are among the most suitable in Korea for intensive forest development. Most of this land is used for forest and is chiefly in capability classes VI and VII.

These soils are not recommended for cultivation, because they have steep slopes, are shallow and have poor workability.

Commercial timber production on this land is very good. The soils have adequate moisture holding capacity and high organic matter content.

Scattered areas which are located on mountain foot slopes and local valleys are recommended for cultivated crops and in places for paddy rice because they have sufficient depth and high organic matter content. Erosion control is the most important management to be considered in the use of this land. Shifting cultivation in the steep sloping areas should be controlled or stopped.

Development possibilities: Soils in this unit are now mostly in woodland. Forest production could be increased by improved management.

Approximate Correlation of Principal Soils in General Soil Map Units with Revised U.S.D.A. Classification and World Soil Map legend

	General Soil Map 1938 U.S.D.A. Soil Classification	1967 U.S.D.A. Soil Classification	FAO/UNESCO World Soil Map legend (1970)
A1	Low-Humic Gley and Alluvial Soils, Fluvio-Marine Phase	Haplaquepts Haplaquents Ochraqualfs	Eutric Gleysols Eutric Fluvisols Gleyic Luvisols
A2	Alluvial Soils and Low-Humic Gley, Continental Phase	Haplaquepts Haplaquents Udifluvents	Dystric Gleysols Eutric Gleysols Dystric Fluvisols
B1	Red-Yellow Podzolic Soils	Hapludults Hapludalfs Dystrochrepts	Orthic Acrisols Orthic Luvisols Dystric Cambisols
B2	Red-Yellow Podzolic Soils and Lithosols	Dystrochrepts Hapludults Hapludalfs	Dystric Cambisols Orthic Acrisols Orthic Luvisols Lithosols
B3	Red-Yellow Podzolic Soils with High Base Status, Calcareous and Mafic Materials	Hapludalfs Eutrochrepts	Orthic Luvisols Eutric Cambisols
B4	Andosols and Lithosols	Dystrandepts	Humic Andosols Lithosols
C1	Red-Yellow Podzolic Soils and Regosols, Siliceous Materials	Dystrochrepts Hapludults	Dystric Cambisols Orthic Acrisols
C2	Red-Yellow Podzolic Soils with high base status and Lithosols, Calcareous Materials	Eutrochrepts Hapludalfs	Eutric Cambisols Orthic Luvisols Lithosols
C3	Lithosols, and Regosols Weakly Developed Soils Micaceous and Hard Siliceous Materials	Dystrochrepts Udorthents	Dystric Cambisols Eutric Rhegosols Lithosols
C4	Lithosols, with some Red-Yellow Podzolic Soils of high base status on sedimentary (Argillic-Arenaceous) materials	Eutrochepts Hapludults	Eutric Cambisols Lithosols
C5	Lithosols, and Red-Yellow Podzolic Soils, Siliceomafic materials	Eutrochrepts Hapludults Hapludalfs	Eutric Cambisols Orthic Acrisols Orthic Luvisols Lithosols

General Soil Map 1938 U.S.D.A. Soil Classification		1967 U.S.D.A. Soil Classification	FAO/UNESCO World Soil Map legend (1970)
D1	Acid Brown Forest Soils	Haplumbrepts Dystrochrepts Hapludults	Humic Cambisols Dystric Cambisols Rankers Orthic Acrisols
D2	Lithosolic Soils, and Acid Brown Forest Soils	Dystrochrepts Haplumbrepts Hapludults	Dystric Cambisols Rankers Humic Cambisols Orthic Acrisols