

PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE GUAYABO DATE 29 12 85
 LOCATION PONTON WEATHER FINE SURVEYED BY S. TAKADA
 CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON $\alpha = 0.1472$ kg/GRADUATION
 GROUND ELEVATION m AREA OF CONE $A = 6.95$ cm² VELOCITY OF PENETRATION cm/sec
 $\beta = \alpha / A = 0.06856$ kg/cm² GRADUATION

DEPTH m	RECORD OF P.R. R	qc = $\beta \alpha R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	qc kg/cm ²									
						0	5	10	20	30	40	50			
0.5	15.0	4.03													
0.5	123.0	9.43													
1.0	125.0	8.57													
1.6	240.0	16.75													
2.0	245.0	16.80													
2.5	289.0	19.81													
3.0	252.0	17.28													
3.5	325.0	22.78													

LEGEND OF SYMBOLS

	GRAVEL		CLAY		SILT
	SAND		PEAT		

PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE GUAYABO DATE 10 12 85
PONTON

LOCATION : No 2 WEATHER FINE SURVEYED BY S. TAKADA

CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON $\alpha = 0.4422$ kg / GRADUATION
 $\beta = \alpha / A$

GROUND ELEVATION m AREA OF CONE $A = 6.75$ cm² VELOCITY OF PENETRATION cm/sec
 $= 0.06856$ kg/cm² GRADUATION

DEPTH m	RECORD OF P, R R	q_c $= \beta \alpha R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE - PTION	q_c kg/cm ²						
						0	5	10	20	30	40 50	
0.5	57.0	3.91										
1.0	105.0	7.20										
1.5	241.0	16.52										
2.0	320.0	21.94										
2.5	372.0	25.50										
3.0	333.0	22.83										
3.5	457.0	36.33										

LEGEND OF SYIMBOLS

- GRAVEL
- CLAY
- SILT
- SAND
- PEAT

PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE GUAYABO DATE 12 12 85
RINCON MOLINILLO
 LOCATION : No 2 WEATHER FINE SURVEYED BY S. TAKADA
 CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON : $\alpha = 0.4422$ kg / GRADUATION
 GROUND ELEVATION _____ m AREA OF CONE : $A = 6.95$ cm² VELOCITY OF PENETRATION : $\beta = \alpha / A$
 = 0.06356 kg/cm² GRADUATION
 = _____ cm/sec

DEPTH m	RECORD OF P.R. R	qc = $\beta \cdot R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	qc kg/cm ²						
						0	5	10	20	30	40	50
0.5	89.0	6.10										
1.0	125.0	9.94										
1.5	147.0	10.08										
2.0	142.0	9.73										
2.5	180.0	12.34										
3.0	185.0	12.68										
4.5	232.0	15.91										
8.75	218.0	14.95										

LEGEND OF SYMBOLS

	GRAVEL		CLAY		SILT
	SAND		PEAT		

PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE SUAYABO DATE 12 12 85
 LOCATION RINCON HOLIVILLO
No 1 WEATHER FIVE SURVEYED BY S. ZARADA

CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON $\alpha = 0.0022$ kg/GRADUATION
 $\beta = \alpha / A$

GROUND ELEVATION m AREA OF CONE $A = 6.75$ cm² VELOCITY OF PENETRATION $= 0.06856$ kg/cm² GRADUATION
1 cm/sec

DEPTH m	RECORD OF P,R R	q_c $= \beta \cdot R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	q_c kg/cm ²									
						0	5	10	20	30	40	50			
0.5	49.0	3.36													
1.0	124.0	8.30													
1.5	181.0	12.41													
2.0	173.0	11.86													
2.5	206.0	14.12													
3.0	225.0	15.73													
3.5	281.0	19.27													
3.75	367.0	25.16													

LEGEND OF SYMBOLS

	GRAVEL		CLAY		SILT
	SAND		PEAT		

PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE GUYABO MAIN CANAL DATE 09 12 85
BEBEDERO
 LOCATION 1/6 WEATHER FINE SURVEYED BY S. RADA J. CRTIS
 CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON $\alpha = 0.4422$ kg / GRADUATION
 $\beta = \alpha / A$
 $= 0.06936$ kg/cm² GRADUATION
 GROUND ELEVATION _____ m AREA OF CONE $A = 6.75$ cm² VELOCITY OF PENETRATION 1 cm/sec

DEPTH m	RECORD OF P.R. R	qc = $\beta \alpha R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	qc kg/cm ²										
						0	5	10	20	30	40	50				
0.5	53.0	3.63														
1.0	185.0	12.68														
1.5	113.0	7.74														
2.0	110.0	7.54														
2.5	196.0	13.44														
3.0	245.0	16.80														
3.5	104.0	7.13														
4.0	238.0	16.37														
4.5	216.0	14.81														
5.0	243.0	16.66														
5.5	270.0	18.51														
6.0	293.0	20.09														
6.15	324.0	24.21														

LEGEND OF SYMBOLS

-  GRAVEL
-  CLAY
-  SILT
-  SAND
-  PEAT

PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE GUAYABO MAIN CANAL DATE 10 12 85

LOCATION BEBEYERO WEATHER FINE SURVEYED BY S. TAKAD J. ORTIZ

CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON $\alpha = 0.4422$ kg/GRADUATION

GROUND ELEVATION _____ m AREA OF CONE $A = 6.75$ cm² VELOCITY OF PENETRATION $\beta = \alpha/A = 0.06856$ kg/cm² GRADUATION

DEPTH m	RECORD OF P,R R	qc = $\beta \alpha R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	qc kg/cm ²
0.5	47.0	2.54				
1.0	75.0	3.38				
1.5	55.0	3.77				
2.0	64.0	4.38				
2.5	89.0	6.10				
3.0	92.0	6.31				
3.5	118.0	8.09				
4.0	164.0	11.24				
4.5	213.0	14.60				
5.0	209.0	14.33				
5.5	266.0	18.24				
6.0	229.0	15.70				
6.5	229.0	15.70				
7.0	199.0	13.64				
7.5	373.0	25.57				
8.0	288.0	19.75				
8.5	310.0	21.25				
9.0	329.0	22.56				

LEGEND OF SYMBOLS

-  GRAVEL
-  CLAY
-  SILT
-  SAND
-  PEAT

PORTABLE CONE PENETROMETER TEST

PROJECT AQUACATE GUAYABO DATE 10 12 85

LOCATION BEBEDERO WEATHER FINE SURVEYED BY S. TAKADA






CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON $\alpha = 0.4422$ kg/GRADUATION

GROUND ELEVATION _____ m AREA OF CONE $A = 6.75$ cm² $\beta = \alpha/A = 906956$ kg/cm² GRADUATION

VELOCITY OF PENETRATION 1 cm/sec

DEPTH m	RECORD OF P,R R	q_c = $\beta \alpha R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	q_c kg/cm ²													
						0	5	10	20	30	40	50							
0.5	14.0	0.96		x															
1.0	25.0	1.74	100	x-x	PEAT														
1.5	24.0	3.02																	
2.0	63.0	4.32																	
2.5	25.0	1.71			very soft clay														
3.0	103.0	7.06	2.80																
3.5	152.0	10.42																	
4.0	122.0	9.74																	
4.5	178.0	12.20																	
5.0	182.0	12.48																	
5.5	232.0	15.91																	
6.0	219.0	15.01																	
6.5	158.0	10.83																	
7.0	304.0	20.84																	
7.5	378.0	25.92																	
8.0	331.0	22.69																	
8.5	415.0	28.45	850		soft clay														

LEGEND OF SYMBOLS

-  GRAVEL
-  CLAY
-  SILT
-  SAND
-  PEAT

PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE GUAYABO DATE 11 12 85
AGUACATE ARENOSO
 LOCATION : No A-1 WEATHER CLOUDY SURVEYED BY S. TAKADA

CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON : $\alpha = 0.4422$ kg/GRADUATION
 $\beta = \alpha / A$

GROUND ELEVATION _____ m AREA OF CONE : $A = 6.25$ cm² $\beta = 0.06856$ kg/cm² GRADUATION:
 VELOCITY OF PENETRATION 1 cm/sec

DEPTH m	RECORD OF P,R R	$q_c = \beta \cdot R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	q _c kg/cm ²								
						0	5	10	20	30	40	50		
0.5	32.0	2.19												
1.0	47.0	3.22												
1.5	71.0	4.87												
2.0	72.0	4.94												
2.5	109.0	7.47												
3.0	207.0	14.19												
3.15	398.0	23.86												

LEGEND OF SYMBOLS

GRAVEL	CLAY	SILT
SAND	PEAT	

PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE GUAYABO DATE 11 12 85
AGUACATE - ARENOSO

LOCATION % A-2 WEATHER _____ SURVEYED BY S. JACOB

CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON $\alpha = 0.4422$ kg/GRADUATION
 $\beta = \alpha / A$

GROUND ELEVATION _____ m AREA OF CONE $A = 6.75$ cm² $\beta = 0.06856$ kg/cm² GRADUATION
 VELOCITY OF PENETRATION _____ cm/sec

DEPTH m	RECORD OF P,R R	qc = $\beta \cdot R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	qc kg/cm ²													
						0	5	10	20	30	40	50							
0.5	80.0	5.48																	
1.0	246.0	16.87																	
1.5	341.0	23.38																	

LEGEND OF SYMBOLS

	GRAVEL		CLAY		SILT
	SAND		PEAT		

PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE GUAYABO DATE 11 12 85
AGUACATE ARENOSO

LOCATION No. A-6 WEATHER CLOUDY SURVEYED BY S. TAKADA

CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON $\alpha = 0.4422$ kg/GRADUATION
 $\beta = \alpha / A$

GROUND ELEVATION m AREA OF CONE $A = 6.25$ cm² VELOCITY OF PENETRATION cm/sec
 $= 0.06856$ kg/cm² GRADUATION

DEPTH m	RECORD OF P.R. R	qc = $\beta \cdot R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	qc kg/cm ²
0.5	118.0	8.09				
1.0	198.0	13.57				
1.5	220.0	21.94				
2.0	267.0	18.31				
2.5	299.0	20.50				
3.0	237.0	16.25				
3.5	272.0	18.65				
3.75	294.0	20.16				
4.0	287.0	19.68				
4.4	354.0	24.27				

LEGEND OF SYMBOLS

	GRAVEL		CLAY		SILT
	SAND		PEAT		






PORTABLE CONE PENETROMETER TEST

PROJECT AGUACATE GUAYABO DATE 12 12 85
 LOCATION ARENSO - VILLA RIVA WEATHER SURVEYED BY S. TAKADA

CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON $\alpha = 0.9422$ kg/GRADUATION
 $\beta = \alpha / A$
 GROUND ELEVATION m AREA OF CONE $A = 6.75$ cm² $\beta = 0.06856$ kg/cm² GRADUATION
 VELOCITY OF PENETRATION 1 cm/sec

DEPTH m	RECORD OF P,R R	qc = $\beta \cdot R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	qc kg/cm ²									
						0	5	10	20	30	40	50			
0.5	95.0	6.51													
1.0	126.0	8.64													
1.5	197.0	13.51													
2.0	321.0	22.01													
2.3	361.0	24.75													

LEGEND OF SYMBOLS

-  GRAVEL
-  CLAY
-  SILT
-  SAND
-  PEAT

PORTABLE CONE PENETROMETER TEST

PROJECT AQUACATE GRAYABO DATE 13 12 85
 LOCATION ARENOSO-VILLA RIVA SURVEYED BY S. TAKADA
 : No. A-13 WEATHER EWE

CAPACITY OF PROVING RING 100 kg COEFFICIENT OF COMPARISON : $\alpha = 0.0022$ kg / GRADUATION
 : $\beta = \alpha / A$

GROUND ELEVATION _____ m AREA OF CONE : $A = 6.95$ cm² = 0.06856 kg/cm² GRADUATION
 VELOCITY OF PENETRATION 1 cm/sec

DEPTH m	RECORD OF P.R. R	qc = $\beta \cdot R$ kg/cm ²	DEPTH m	SYMBOL	DISCRE- PTION	qc kg/cm ²										
						0	5	10	20	30	40	50				
0.5	50.0	3.43														
1.0	70.0	4.80														
1.5	378.0	23.86														
1.65	334.0	22.90														

LEGEND OF SYMBOLS

	GRAVEL		CLAY		SILT
	SAND		PEAT		

ANNEX D: SOIL

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ANNEX D: SOIL

1. Introduction

Reclamation of the waste lands for increasing agricultural production under the systematic supply of irrigation water would be a prerequisite for successful growth and development of farm economy in the local region. The study area of Aguacate-Guayabo has been selected to be urgently studied in AGLIPO Development Program following the El Pozo Project.

The soil survey in relation with its geological and topographical features presents scientific information useful for making the reasonable and necessary land development.

Objectives of the soil survey undertaken by the Study Team are:

- 1) to conduct soil profile observation for checking/confirming the results of the former soil survey;
- 2) to survey the availability of the peat lands which will be expanded under the drainage system; and
- 3) to investigate suitability and problems of soil and water quality for improving agricultural management aimed at increasing farm production.

The survey was carried out in two phases: Phase I, from August to September 1985, and Phase II in December 1985, in cooperation with the Dominican Institutions and Counterparts.

2. Geography and Land Use

2.1 General

The study area is located at the northeast of the country, bordering on El Pozo area on the northwest. The area is bounded by the Escocesa Bay and Loma la Cordillera on the north to northeast, by the Samana Bay on the east, by the Yuna River on the south, and by Loma Remanente de Yabacoa on the southwest. Its total area is 24,100 ha, lying between 69°37' and 53' in West Longitude and 19°09' and 16' in North Latitude.

Topographical maps scaled at 1:25,000 were used for the field survey, and the results were checked by the new maps scaled at 1:10,000 which were provided by JICA.

2.2 Topography and Geology

A greater part of the area is mostly flat flood plain formed by the Yuna River. Although slightly undulating at some parts, the plain slopes very gently towards northern and eastern coasts, in elevation from 10 m to 1 m above sea level.

The lands are largely composed of three distinct physiographic forms namely:

- 1) Alluvial plain and delta area
- 2) Natural levee and coastal terrace area
- 3) Marsh and peat area

The natural levees developed along Yuna River and Caño Gran Estero have been used for upland crops cultivation as well as residential district. The alluvial materials transported are mainly clayey in texture, and silty or sandy in limited area of river levee and sea coast.

Mash and peat areas occupy more than half of the area. The peats, of which decomposition grade vary from fibrous to sapric status cover the clayey lagoonal ground formerly built up behind the coastal dunes.

Two groups of peat land are found in Aguacate and Guayabo; the former stretches from south to northern sea coast, depth of peat layer often reaching 5 to 10 m nearby the under-surveyed dam site area; the latter prevails on most of Guayabo area towards the Samana Bay, bearing swampy forests in many places.

Areas in higher elevation more than 10 m are divided into two groups; namely, Cordillera piedmonts in the northeast, and Yabacoa remnant hills, in elevation up to 80 m in the area. Fig. D.2.1 is a partial geological map taken from ATLAS Geologico y Mineralogico de la Republica Dominicana (1969). It illustrates that the former consists of limestones of tertiary miocene, with karstic topography, while the latter, of limestones and conglomerate of tertiary miocene and oligocene. Detailed descriptions of the geological feature are referred to ANNEX C.

2.3 Vegetations and Land Use

Dominant wild grasses and trees are listed in Tables D.2.1 and D.2.2 in terms of taxonomy and growing place. Most characteristic plants in the area are: Jabilla of levee and delta where cacao and plantain are planted; Dragales and Canutillo growing in peat lands; and groups of mangroves thriving on the coastal terrace. Guayabo is also a representative shrub almost all over Guayabo area.

Paddy rice is the most popular crop on the alluvial plain and delta areas and even planted in the lowlying peat lands where peat layer is shallower than 50 cm. Coconut palms are grown everywhere in the area especially concentrated on the piedmont and monadnock areas. Very few areas are cultivated with upland crops such as maize and peanut, occupying only 2 percent of the whole area. The only crop cultivable on the deep peat lands is Pipiota, *Alocasia* species. Its tubers of good quality are being exported as well as Yautia which is grown on well-drained sloping lands.

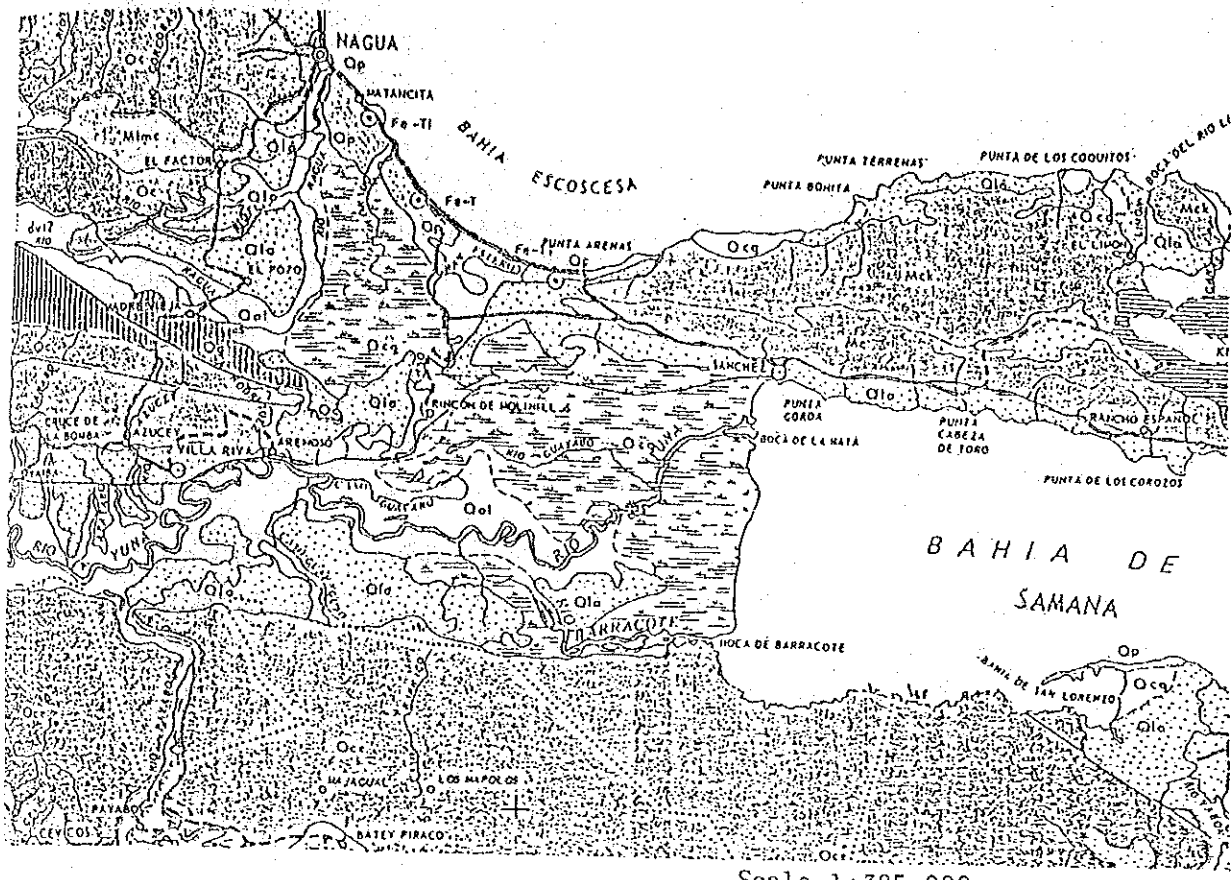
Details of the present land use are referred in ANNEX F. The peat lands are difficult to be reclaimed for agricultural use even with highest investment. Although partially used as wild pasture at present, these lands should be preferably left untouched, including swamp and mangrove forests from the viewpoints of natural conservation. This problem is discussed in the latter chapter.

TABLE D.2.1 LIST OF POPULAR WILD GRASSES PREVAILING IN THE STUDY AREA

No.	Local Name	Family	Genus-Species	Growing Area
1	Canutillo	Gramineae	<i>Hymenachne amplexicaulis</i>	Peat land
2	Pie Gallo	"	<i>Chloris radiata</i>	Terrace and delta
3	Pangola	"	<i>Digitaria decumbens</i>	"
4	Yerba de Guinea	"	<i>Panicum maximum</i>	"
5	Yerba Páez	"	" <i>tenèrum</i>	"
6	Papaó Arrocillo	"	<i>Themeda quadrivalvis</i>	"
7	Saladillo	"	<i>Paspalum distachyon</i>	"
8	Pajón	"	<i>Saugetia fasciculata</i>	"
9	Gramá	"	<i>Echinochloa colonam</i>	"
10	Yaraguá	"	<i>Melinis minutiflora</i>	Monadnock
11	Corta-Corta	Cyperaceae	<i>Cyperus sp.</i>	Terrace and delta
12	Lambara	"	<i>Scleria secans</i>	"
13	Junquillo	"	<i>Eleocharis interstincta</i>	Delta and Marsh
14	Pelo de Mico	"	<i>Rhynchelytrum repens</i>	Terrace and delta
15	Enea	Typhaceae	<i>Typha domingensis</i>	Marsh
16	Yautía Cimarron	Araceae	<i>Alocasia sp.</i>	Terrace and delta
17	Suelda Consuelda	Commelinaceae	<i>Commelina erecta</i>	Plain and delta
18	Molinillo	Labiatae	<i>Leonotis nepetifolia</i>	"
19	Yerba Amarga	Compositaceae	<i>Piqueria Trinervia</i>	"
20	Rompe Saraguey	"	<i>Eupatorium odoratum</i>	"
21	Salvia	"	<i>Pluchea purpuracens</i>	"
22	Pringamosa	Euphorbiaceae	<i>Tragia volabilis</i>	"
23	Moriru Bibil	Leguminosae	<i>Mimosa pudica</i>	Terrace and delta
24	Berro	Cruciferae	<i>Nasturtium officinale</i>	Plain and marsh
25	Platanito	Amaranthaceae	<i>Philoxerus vermicularis</i>	"

TABLE D.2.2 LIST OF POPULAR WILD ARBORS AND SHRUBS
PREVAILING IN THE STUDY AREA

No.	Local Name	Family	Genus-Species	Growing Area
1	Dragales	Leguminosae	<i>Pterocarpus officinalis</i>	Marsh and peat area
2	Tamarindo	"	<i>Tamarindus indica</i>	Plain and marsh
3	Guamas	"	<i>Inga vera</i>	"
4	Piñon cubano	"	<i>Gliricidia sepium</i>	"
5	Guayabo	Myrtaceae	<i>Psidium guajava</i>	Terrace and delta
6	Guaráno	Sapindaceae	<i>Cupaina americana</i>	"
7	Mangles prieto	Rhizophoraceae	<i>Conocarpus erectus</i>	Coastal terrace
8	"	"	<i>Leguncularia racemosa</i>	"
9	Mangles colorao	"	<i>Phizophora mangle</i>	"
10	"	"	<i>Garrya fadyenii</i>	"
11	Amapola	Bignoniaceae	<i>Spathodea companulata</i>	Terrace and plain
12	Jobo	Anacardiaceae	<i>Spondias mombin</i>	"
13	Mara	Guttiferae	<i>Calophyllum calaba</i>	"
14	Almendra	Combretaceae	<i>Terminalia catappa</i>	"
15	Jaquay	Moraceae	<i>Ficus aurea</i>	"
16	Hojancha	Polygonaceae	<i>Coccoloba pubecens</i>	"
17	Behuco	Vitaceae	<i>Masechites repens</i>	"
18	Behuco caro	"	<i>Ciccus sicyoides</i>	"
19	Jobilla	Euphorbiaceae	<i>Hura crepitans</i>	Levee and delta



Scale 1:385,000

COLUMNA ESTRATIGRAFICA

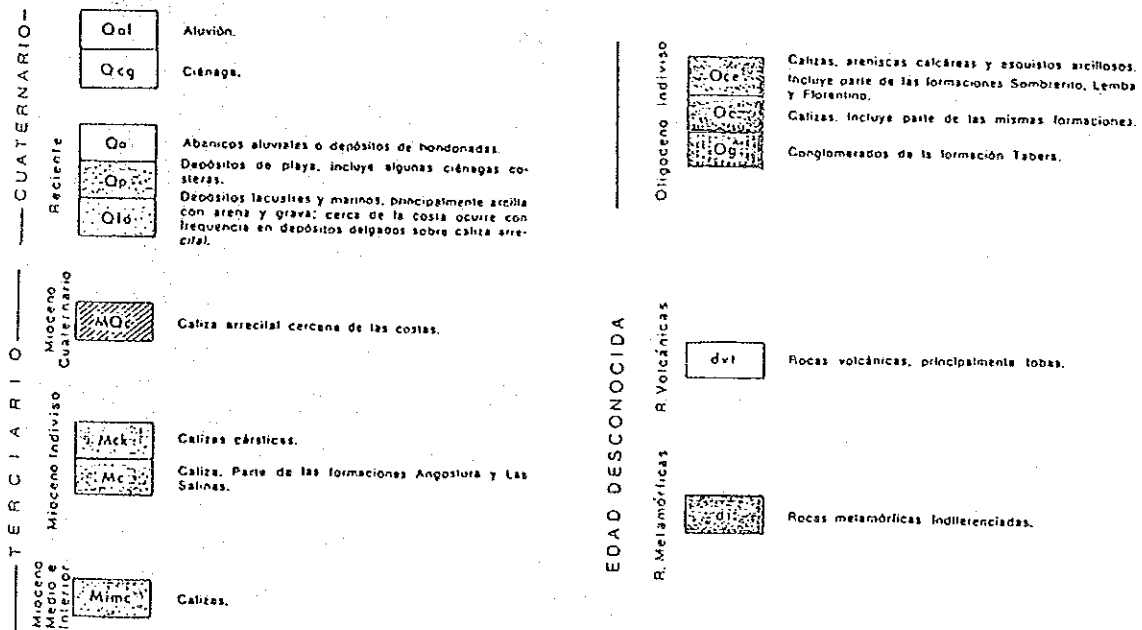


FIG. D.2.1 GEOLOGICAL AND MINERALOGICAL MAP AROUND THE PROJECT AREA

3. Soil Suvery

3.1 General

The study area was already surveyed together with El Pozo Area by FAO and Dominican staff. The survey report was published in 1976 with the map of soil series scaled at 1:50,000. As aforementioned, the present survey has attempted to check the soil map with the intention of concentrated study of peat soil. However, the survey has not been carried out as planned due to the following reasons:

- 1) Marsh and peat area were less accessible than expected under the unsettled weather with frequent heavy showers, causing flood and traffic troubles.
- 2) To complete soil map of the study area, not a few days has to be spent for surveying the piedmont and monadnock areas which were excluded in the FAO Report.

Consequently, within the limited survey period, soil profile observation has been focused upon the development feasible areas including peat lands which are expected to present the informations useful for land suitability classification, too.

3.2 Soil Profile Observation

Pit sites were selected on every typical land group topographically identified. In both survey periods most of the paddy fields were transplanted or being prepared for the next crop. On such fields the boring technique was used for observation and sampling similarly as peat lands occasionally inundated.

Soil profiles observed totalled 94 through the two phases (I and II), resulting in a semi-detailed reconnaissance survey density, around one pit per 250 ha.

Pit site distribution was topographically as follows:

1) Marsh peat soil area	19 sites
2) Wetland peaty soil area	13 sites
3) Plain and delta soil area	42 sites
4) Piedmont and monadnock area	20 sites
Total	94 sites

Their locations are given in Tables D.3.1 and D.3.2, and Fig. D.3.1.

Outlines of the survey method are described below:

(1) Pit

The pits were dug up to a depth of 80 to 120 cm from the surface with a width of 100 cm. To observe further the lower layers of the pit, boring was tried using a common posthole type auger.

(2) Soil Hardness Test

Field test was conducted to determine soil hardness. A tester, a kind of cone penetrometer to measure soil compactness, was used since it is handy and portable for the field survey. Compactness of the soil layer is of much importance to determine workability of a land for potentiality classification as well as to distinguish genetic differences in the soil classification process.

Values resulting from the use of the soil hardness tester are categorized as follows:

CRITERIA OF SOIL HARDNESS EVALUATION

Hardness Category	Tester Index* (mm)	Resistance (kg/cm)	Easiness in Tillage Work
Soft	8	0.98	Very easy
Slightly Hard	8 - 12	0.98 - 1.93	Easy
Hard	12 - 17	1.93 - 4.04	Slightly difficult
Very Hard	17 - 23	4.04 - 10.0	Difficult
Extremely Hard	23	10.0	Very difficult

* Dr. Yamanaka's Soil Hardness Tester. Index (mm) is a reading of the cone when it penetrates into the solum.

(3) Chemical Tests

Quick chemical reagent tests were tried with every soil profile. These are:

- a. Dilute hydrochloric acid solution (10%) for detecting carbonates (effervescence),
- b. Benzidin (pp'-diamino-diphenyl salt) solution (one percent in 10 percent acetic acid solution) for detecting active manganese (dark blue color development), and
- c. α '-dipyridyl solution (0.05 percent in 10 percent acetic acid solution) for detecting ferrous iron (Fe⁺⁺)(pink-red color development).

The soil profile description followed the method defined in the FAO Guidelines for Soil Profile Description which are now of wider use in the world.

3.3 Sampling and Analysis

3.3.1 Sampling and Field Analysis

Soil horizons of the typical profile were sampled and air-dried. Fine soil samples were then prepared through a 2 mm sieve, when content of gravels (>2 mm) was measured.

As noted in Tables D.3.1 and D.3.2, 132 samples of the fine soil through two phases were analyzed for pH and electrical conductivity (EC) by means of portable electrode meters.

In the course of the soil survey, 67 water samples from various sources were also collected and analyzed similarly as the soil samples. These results are given in Tables D.3.3, D.3.4, D.3.5 and D.3.6, for survey stage (I) and (II), respectively.

3.3.2 Laboratory Analysis

Out of 132 soil samples, the 66 samples (fine soil) were subjected to further physical and chemical analysis at Soil Laboratory of INDHRI. The data are presented in Tables D.3.7, D.3.8, D.3.9 and D.3.10.

TABLE D.3.1 LIST OF SOIL PIT SITES AND SAMPLING (I) (1)

Pit No.	Location	Elevation (m)	Land Use	Groundwater Level (cm)	Soil Sample	
					Number	Sum
1	Los Naranjos, El Poso	1.8	Gr (Co)	105	4	4
2	Cruce Rincón, Sanchez	2.2	Gr-Tu	0*	4**	8
3	Rincón Molinillo, Aguacate	1.5	Ar (Prep.)	113	4**	12
4	El Catey I, Sanchez	1.8	Gr-Tu (Pi)	0	-	-
5	El Catey II, "	2.4	Gr-Tu	0	-	-
6	La Majagua, "	2.6	Ar-Tu	0*	-	-
7	San Rafael, R.M., Aguacate	2.5	Ca	>100	3**	15
8	San Rafael, " , "	5.0	Ca	>100	3**	18
9	Rincón Molinillo, "	3.8	Gr	75	3**	21
10	Madrid Sector, Guayabo	2.5	Ar	34	-	-
11	El Jobo I, Aguacate	3.8	Ar	0*	-	-
12	El Jobo II, Guayabo	4.2	Gr	33	-	-
13	Milla Seis, "	1.5	Gr-Tu (Ar)	28	2	23
14	Milla Cinco, Sanchez	1.3	Gr-Tu	0	3**	26
15	Milla Cinco, "	2.8	Gr-Tu	46	-	-
16	Los Mango, "	1.5	Gr-Tu	70	3**	29
17	Bucham Javiel, "	2.8	Gr-Tu	74	-	-
18	La Majagua, "	25.0	Co	>200	3**	32
19	El Pelao, Aguacate	2.7	Ar (Gr)	40	3	35
20	La Mat, "	5.0	Gr	15	-	-
21	Cienega Vieja I., "	7.4	Gr	70	3**	38

TABLE D.3.1 LIST OF SOIL PIT SITES AND SAMPLING (I) (2)

Pit No.	Location	Elevation (m)	Land Use	Groundwater Level (cm)	Soil Sample	
					Number	Sum
22	Ciénega Vieja II., Aguacate	6.3	Gr	>100	-	-
23	La Raya de Yuna I., "	6.4	Gr	20*	-	-
24	La Raya " II., "	6.0	Gr (Ar)	30	-	-
25	Las Coles, "	6.0	Ar	23	-	-
26	Las Coles Abajo, Guayabo	6.4	Gr	42	3**	41
27	El Guayabo (Zona B), "	1.4	Ar	+15	-	-
28	Rincon Grande, "	2.4	Gr (Ar)	46	-	-
29	Las Carreras, "	4.5	Ba (Ca, Pi)	115*	3	44
30	Arenoso, Aguacate	8.0	Gr-Tu	65	3**	47
31	Los Haitises, "	3.8	Gr-Tu	19	-	-
32	El Guayabo, Guayabo	1.4	Gr (Ar)	32	-	-
33	" , "	1.4	Ar	+10	-	-
34	Los Cacaos, "	2.4	Ar	+5	-	-
35	El Pelao, Aguacate	4.8	Ar-Tu	74	3**	50
36	Caño, Abajo, "	6.2	Gr	>100	-	-
37	Pescadero, El Pozo	1.6	Ar-Tu	40	3	53
38	Caño Gran Estero, Aguacate	2.0	Gr	90	5**	58
39	Caño Gran Estero, Sanchez	2.3	Co	70	-	-
40	La Cañita, "	4.0	Co	80	-	-
41	Los Mangos, "	23	Co (Ma, Ca)	>200	-	-
42	Agua Buena, "	23	Co	>200	4**	62

TABLE D.3.1 LIST OF SOIL PIT SITES AND SAMPLING (I) (3)

Pit No.	Location	Elevation (m)	Land Use	Groundwater Level (cm)	Soil Sample	
					Number	Sum
43	El Catey, Sanchez	18	Co	>200	-	-
44	La Lometa de Rincón, Aguacate	2.5	Ba (Ca)	>150	-	-
45	Caño Cuba Libre, Aguacate	0.4	Gr	30	-	-
46	El Catey, Sanches	17	Pe	83	3**	65
47	Cruce Pescadero, El Pozo	1.6	Ca (Co, Ba)	>130	3	68

Note: Land Use: Ar - rice; Ba-banana, platano; Ca - cacao; Co - Coconut; Ga - guayabo;
 Gr - grassland; Ma - mango; Mg - mangrove; Pe - peanut; Pi - pipiota;
 Tu - peat land; Ya - Yautia

Groundwater: + marks the depth of surface water.

* Not sampled

** Subjected to the laboratory analysis.

TABLE D.3.2 LIST OF SOIL PIT SITES AND SAMPLING (II) (1)

Pit No.	Location	Elevation (m)	Land Use	Groundwater Level (cm)	Soil Sample	
					Number	Sum
48	La Lometa Rincón, Aguacate	6.4	Co	>200	2	2
49	"	8.0	Co-Gr	>100	-	-
50	El Catey, Sanchez	17.0	Co (Ga)	>100	4	6
51	La Majagua, "	30.0	Co (Ma)	>200	-	-
52	Los Mangos, "	26.0	Ya-Co	>200	4	10
53	Agua Buena, "	40.0	Co-Ya	>200	3	13
54	AC-101 (Sector), Aguacate	1.8	Gr (Ar)	57	-	-
55	El Pelao, "	4.6	Ar-Tu	10	4**	17
56	Los Haitises, "	22.0	Gr	>200	2	19
57	Aguacate, "	7.4	Gr-Tu	65	4**	23
58	Arenoso, Arenoso	28.0	Gr	>150	-	-
59	AC-2 (Sector), Aguacate	4.0	Ar (Gr)	54*	-	-
60	Aguacate, "	6.6	Ar	60*	-	-
61	La Curva, Arenoso	8.3	Gr	120	-	-
62	Arenoso, "	15.0	Gr	>200	5	28
63	Yabacoa, "	30.0	Gr	>200	4**	32
64	Los Platanijos, Arenoso	8.0	Gr	>180	-	-
65	La Raya, "	6.4	Ar	50*	-	-
66	Las Coles, Arenoso	4.6	Gr	50	-	32
67	Cruce La Cabirma, Guayabo	6.6	Gr (Ar)	80*	4**	36
68	La Garza, "	4.5	Ar	50	-	-

TABLE D.3.2 LIST OF SOIL PIT SITES AND SAMPLING (II) (2)

Pit No.	Location	Elevation (m)	Land Use	Groundwater Level (cm)	Soil Sample	
					Number	Sum
69	Los Cacaos, Guayabo	6.6	Ar (Gr)	67	-	-
70	Las Carreras, "	4.4	Gr (Ar)	120	-	-
71	El Guayabo, "	3.8	Ba	>150	4	40
72	El Mango, "	3.3	Gr	54	-	-
73	Los Chicharrojes, Sanchez	80.0	Co-Gr	>200	-	-
74	Agua Buena, "	28.0	Co-Gr	>200	-	-
75	Km 12, Guayabo	2.0	Gr	+17	4	44
76	Rincón Molinillo, Aguacate	4.0	Ar	+15	3	47
77	Los Chichones, "	3.4	Gr	20*	-	-
78	Rincón Molinillo, "	6.0	Ca	>150	-	-
79	Cruce de Rincón, "	2.0	Gr	33*	-	-
80	AC-5 (Sector), "	4.0	Gr	40*	-	-
81	Aguacate, "	8.0	Gr	>200	4	51
82	" , Arenoso	8.4	Gr	+5*	-	-
83	Madrid, Aguacate	3.6	Gr	20*	3	54
84	El Jobo, "	3.8	Gr	7	-	-
85	" , "	3.0	Gr	40	-	-
86	Atronca Pellos, Aguacate	4.6	Gr	40	-	-
87	La Lometa, "	2.3	Tu (Pi)	0	3	57
88	" , "	2.6	Tu	0	-	-
89	El Catey, Sanchez	25.0	Co (Gr)	>200	-	-

TABLE D.3.2 LIST OF SOIL PIT SITES AND SAMPLING (II) (3)

Pit No.	Location	Elevation (m)	Land Use	Groundwater Level (cm)	Soil Sample	
					Number	Sum
90	Loma del Catey, Sanchez	2.0	Tu-Gr	0	-	-
91	"	0.8	Gr-Tu	+10	2	59
92	Boca del Medio, Guayabo	0.5	Mg	15*	2	61
93	La Bales,	0.4	Ar-Mg	13*	3	64
94	Rio Guayabo,	0.8	Tu-Ar	10*	-	-

Note: Land Use: Ar - rice; Ba-banana, platanos; Ca - cacao; Co - Coconut; Ga - guayabo;
 Gr - grassland; Ma - mango; Mg - mangrove; Pe - peanut; Pi - pipiota;
 Tu - peat land; Ya - Yautia

Groundwater: + marks the depth of surface water.

* Not sampled.

** Subjected to the laboratory analysis.

TABLE D.3.3 RESULTS OF FIELD ANALYSIS OF SOIL SAMPLES (I-1)

Sample No.	Depth cm	Soil Hardness	Soil/Water Ratio	pH	EC mmho/cm, 25°C
P1 -1	0-25	20	1:2	5.60	0.09
-2	25-53	23	"	6.47	0.05
-3	53-74	22	"	6.54	0.04
-4	74-105	18	"	6.35	0.03
P2 -2	0-26	7	1:4	5.60	0.51
-2	26-42	5	1:2	5.84	0.24
-3	42-60	-	"	6.17	0.08
-4	60-90	-	"	6.36	0.11
P3 -1	0-10	3	"	4.50	0.43
-2	10-47	13	"	5.66	0.30
-3	47-95	12	"	7.73	0.20
-4	95-130	16	"	6.14	0.35
P7 -1	0-7	9	"	6.04	0.08
-2	7-46	18	"	6.46	0.02
-3	46-93	23	"	6.38	0.03
P8 -1	0-9	13	"	5.73	0.13
-2	9-21	21	"	5.58	0.04
-3	21-125	20	"	6.33	0.04
P9 -1	0-8	7	"	6.49	0.17
-2	8-30	12	"	6.99	1.00
-3	30-161	12	"	8.31	1.00
P13-1	0-20	7	1:4	5.95	1.01
-2	20-158	5	"	5.57	1.01
P14-2	10-40	-	"	5.77	0.4
-3	40-180	-	"	5.84	0.23
-4	180-270	-	"	5.32	1.70
P16-1	0-12	7	1:2	7.47	3.31
-2	12-33	13	"	6.68	3.12
-3	33-170	18	"	6.54	2.02
P18-1	0-5	13	"	6.12	0.08
-2	5-8	17	"	6.36	0.11
-3	8-130	22	"	4.66	0.02
P19-1	0-10	6	"	6.01	0.02
-2	10-21	15	"	8.06	0.01
-3	21-90	12	"	7.01	0.08

TABLE D.3.3 RESULTS OF FIELD ANALYSIS OF SOIL SAMPLES (I-2)

Sample No.	Depth cm	Soil Hardness	Soil/Water Ratio	pH	EC mmho/cm, 25°C
P21-1	0-6	12	1:2	6.56	0.21
-2	6-23	17	"	7.13	0.26
-3	23-46	17	"	7.68	0.08
P26-1	0-5	14	"	6.47	0.22
-2	5-27	18	"	7.14	0.08
-3	27-127	20	"	7.18	0.06
P29-1	0-6	12	"	7.31	0.12
-2	6-24	20	"	7.30	0.01
-3	24-130	17	"	8.32	0.02
P30-1	0-23	11	1:4	6.64	0.34
-2	23-50	17	1:2	6.11	0.37
-3	50-118	7	"	6.21	0.13
P35-1	0-8	6	"	5.72	0.46
-2	8-17	7	"	5.75	0.32
-3	17-107	18	"	5.92	0.11
P37-1	0-13	8	1:4	5.48	0.34
-2	13-27	7	"	5.44	0.33
-3	27-140	12	1:2	5.40	0.21
P38-1	0-9	5	"	8.22	1.01
-2	9-21	7	"	8.94	0.19
-3	21-41	7	"	8.88	0.18
-4	41-52	10	1:4	7.12	0.57
-5	52-145	-	1:2	7.55	0.08
P42-1	0-17	21	"	5.03	0.10
-2	17-34	21	"	4.90	0.04
-3	34-60	22	"	4.45	0.02
-4	60-80	22	"	4.44	0.02
P46-1	0-15	11	"	4.85	0.08
-2	15-35	19	"	5.74	0.08
-3	35-95	24	"	5.75	0.08
P47-1	0-20	14	"	5.94	0.12
-2	20-31	17	"	6.40	0.06
-3	31-126	19	"	6.57	0.06

TABLE D.3.4 RESULTS OF FIELD ANALYSIS OF SOIL SAMPLES (II-1)

Sample No.	Depth cm	Soil Hardness	Soil/Water Ratio	pH	EC mmho/cm, 25°C
P48-1	0-17	12	1:2	5.49	0.09
-2	17-102	21	"	4.50	0.02
P50-1	0-9	10	"	4.70	0.10
-2	9-33	18	"	4.28	0.09
-3	33-60	20	"	4.41	0.07
-4	60-122	17	"	5.02	0.02
P52-1	0-10	16	"	8.24	0.34
-2	10-15	19	"	8.31	0.32
-3	15-35	20	"	8.63	0.02
-4	35-55	19	"	9.05	0.01
P53-1	0-15	17	"	5.77	0.12
-2	15-35	18	"	6.20	0.12
-3	35-80	16	"	7.66	0.21
P55-1	0-14	7	"	5.57	0.44
-2	14-31	8	"	6.27	0.24
-3	31-49	-	"	5.99	0.24
-4	49-134	-	1:3	5.39	0.34
P56-1	0-30	11	1:2	8.04	0.14
-2	30-100	11	"	8.31	0.12
P57-1	0-6	6	1:4	3.63	0.17
-2	6-24	7	1:3	3.75	0.20
-3	24-35	8	1:2	5.53	0.41
-4	35-93	12	"	5.97	0.31
P62-1	0-20	12	"	7.58	0.36
-2	20-35	15	"	7.95	0.26
-3	35-60	16	"	8.36	0.13
-4	60-100	20	"	8.44	0.18
-5	100-180	22	"	8.45	0.18
P63-1	0-23	20	"	8.18	0.18
-2	23-41	23	"	8.92	0.22
-3	41-56	24	"	8.48	0.14
-4	56-100	25	"	8.60	0.14

TABLE D.3.4 RESULTS OF FIELD ANALYSIS OF SOIL SAMPLES (II-2)

Sample No.	Depth cm	Soil Hardness	Soil/Water Ratio	pH	EC mmho/cm, 25°C
P67-1	0-11	20	1:2	8.21	0.16
-2	11-23	18	"	8.07	0.21
-3	23-39	20	"	8.13	0.22
-4	39-90	16	"	7.90	0.17
P71-1	0-7	14	"	8.15	0.17
-2	7-24	18	"	8.12	0.19
-3	24-56	17	"	8.14	0.17
-4	56-130	20	"	8.05	0.19
P75-1	0-15	5	"	6.08	0.33
-2	16-45	10	-	-	-
-3	45-85	12	1:2	7.03	0.20
-4	85-100	-	"	7.24	0.16
P76-1	0-12	7	"	6.35	0.44
-2	12-60	10	"	6.47	0.41
-3	60-100	-	"	6.54	0.19
P81-1	0-10	20	"	6.36	0.09
-2	10-19	19	"	6.49	0.14
-3	19-51	19	"	6.83	0.06
-4	51-90	21	"	7.16	0.08
P83-1	0-10	8	"	7.05	0.08
-2	10-25	8	"	6.27	0.14
-3	25-55	10	"	6.24	0.27
P87-1	0-30	5	1:3	4.35	0.34
-2	30-190	-	"	3.95	0.41
-3	190-250	-	1:2	5.92	0.26
P91-1	0-8	2	"	7.64	1.75
-2	8-40	5	"	7.71	2.15
P92-1	0-14	7	"	8.23	0.84
-2	14-100	10	"	8.05	0.90
P93-1	0-10	8	"	8.02	2.56
-2	10-30	10	"	8.35	2.50
-3	30-40	-	"	8.50	2.57

TABLE D.3.5 RESULTS OF FIELD ANALYSIS OF WATER SAMPLES (I)

Sample No.	Water Source	Sampling Site	pH	EC (mmho/cm, 25°C)	Sample No.	Water Source	Sampling Site	pH	EC (mmho/cm, 25°C)
1	G	P1	5.83	0.44	22	G	P20	5.75	0.82
2	G	P3	5.95	1.53	23	G	P21	7.42	0.56
3	G	P4	3.30	0.09	24	G	P24	7.01	0.67
4	G	P5	4.52	0.15	25	G	P25	7.46	0.75
5	G	P9	6.21	1.08	26	G	P26	7.12	0.59
6	G	P10	6.08	1.00	27	R	Yuna River	7.95	0.18
7	G	P12	6.37	0.72	28	G	P27	6.77	0.26
8	C	Pontón	6.20	0.24	29	G	P28	7.29	0.13
9	C	Gran Estero, 1	6.46	0.31	30	G	P30	6.61	0.21
10	C	Gran Estero, 2	6.35	0.27	31	G	P31	6.10	0.21
11	C	Aguate	6.68	0.36	32	G	P32	6.31	0.15
12	C	Mal Lomasina	6.51	0.61	33	D	(P32)	7.17	0.44
13	G	P13	6.03	0.40	34	G	P34	6.89	0.41
14	G	P14	6.35	0.30	35	G	P35	6.07	0.57
15	D	P15	7.63	0.28	36	D	Rincon M.	6.21	0.29
16	G	P15	6.34	0.52			Aguate Road		
17	R	Nearby Sanchez	7.80	0.52	37	G	P37	6.05	0.46
18	G	P16	6.95	3.16	38	G	P38	7.19	1.18
19	G	P17	6.63	2.13	39	G	P39	6.47	0.56
20	C	Gran Estero, 3	7.04	2.18	40	G	P40	6.11	0.78
21	G	P19	7.19	0.27	41	W	(P40)	7.73	0.90
					42	G	P45	7.23	2.23

Remarks: Water Sources: G - Groundwater; C - canal; D - drain; R - River; W - well.

TABLE D.3.6 RESULTS OF FIELD ANALYSIS OF WATER SAMPLES (II)

Sample No.	Water Source	Sampling Site	pH	EC mmho/cm, 25°C
1	G	P54	6.25	0.31
2	G	P55	6.06	0.30
3	G	P57	5.70	0.39
4	R	Yuna (Arenoso)	8.06	0.29
5	C	Near P57	7.54	0.40
6	C	P15-55	7.12	0.22
7	C	P19-54	7.32	0.23
8	C	El Poro	7.09	0.22
9	C	Naranjo	6.70	0.20
10	C	Cororao	7.07	0.76
11	C	Matancita	7.31	3.12
12	G	P66	7.99	0.75
13	G	P68	7.02	0.11
14	G	P69	7.21	0.56
15	S	P75	6.70	0.24
16	S	P77	7.80	0.36
17	C	Caño Ponton	6.48	0.23
18	G	P85	7.03	2.16
19	G	P86	6.92	3.79
20	S	P87	4.10	0.08
21	G	P88	4.98	0.08
22	S	P90	6.76	0.40
23	S	P91	6.92	0.70
24	R	Guayabo (1 Km)	6.43	0.32
25	R	" Mouth	6.57	0.30

Remarks: Water Resources: G - groundwater; C - Canal; D - Drain;
R - River; W - Well; S - Surface water

Sample No. 5 to 11 were taken from Caño Gran Estero. The latter 10 and 11 were from nearby mouth, outside of the Project Area.

TABLE D.3.7 RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES (A-I)

Sample No.	Depth cm	pH (1:2.5)	Saturation %	Particle Size Distribution			Texture	CaCO ₃ %
				Clay %	Silt %	Sand %		
P2 -1	0-26	6.6	n.d.	n.d.	n.d.	n.d.	-	t
-2	26-42	6.6	60	36.3	16.0	47.7	SC	t
-3	42-60	6.7	80	56.3	12.0	31.7	C	t
-4	60-90	6.8	80	69.0	14.7	46.2	C	t
P3 -1	0-10	5.8	80	56.3	20.0	23.7	C	t
-2	10-47	6.5	94	70.3	17.0	15.7	C	t
-3	47-95	7.2	100	79.8	18.0	2.2	C	t
-4	95-130	6.4	95	71.0	14.7	14.2	C	t
P7 -1	0-7	6.6	67	41.0	36.7	22.2	C	t
-2	7-46	6.8	57	10.7	22.0	67.3	SL	t
-3	46-93	6.9	68	37.4	41.3	21.3	CL	t
P8 -1	0-9	6.3	69	46.3	33.1	20.6	C	t
-2	9-21	6.3	70	54.3	33.1	12.6	C	t
-3	21-125	6.7	72	48.3	30.1	12.6	C	t
P9 -1	0-8	6.5	75	56.3	23.4	20.2	C	t
-2	8-30	6.9	72	60.3	19.1	20.6	C	t
-3	30-161	7.2	95	63.3	26.1	10.6	C	t
P14-2	10-40	5.5	n.d.	n.d.	n.d.	n.d.	-	t
-3	40-180	5.3	n.d.	n.d.	n.d.	n.d.	-	t
-4	180-270	4.8	n.d.	n.d.	n.d.	n.d.	-	t
P16-1	0-12	6.1	100	55.0	22.4	22.6	C	t
-2	13-33	6.0	100	57.0	20.4	22.6	C	t
-3	33-170	6.4	68	43.0	42.7	14.2	SIC	t
P18-1	0-5	6.0	83	51.4	34.4	14.2	C	t
-2	5-8	6.0	68	51.4	34.4	14.2	C	t
-3	8-130	5.3	90	81.4	10.4	8.2	C	t
P21-1	0-6	5.8	90	49.4	34.4	16.2	C	t
-2	6-23	6.1	86	51.4	36.4	12.2	C	t
-3	23-46	6.3	75	57.4	32.4	10.2	C	t
P26-1	0-5	6.0	75	49.4	32.4	18.2	C	t
-2	5-27	6.1	68	49.4	36.4	14.2	C	t
-3	27-127	6.3	63	43.4	38.4	18.2	C	t
P30-1	0-23	6.0	n.d.	n.d.	n.d.	n.d.	-	t
-2	23-50	n.d.	n.d.	n.d.	n.d.	n.d.	-	t
-3	50-118	6.0	n.d.	n.d.	n.d.	n.d.	-	t
P35-1	0-8	5.7	n.d.	n.d.	n.d.	n.d.	-	t
-2	8-17	5.7	80	55.0	18.4	13.4	C	t
-3	17-107	5.8	95	77.0	8.7	13.6	C	t
P38-1	0-9	6.9	n.d.	n.d.	n.d.	n.d.	-	t
-2	9-21	7.0	33	6.7	0.7	92.6	S	27.8
-3	21-41	7.0	30	7.0	0.7	92.2	S	38.0
-4	41-52	6.4	n.d.	n.d.	n.d.	n.d.	-	t
-5	52-145	6.8	50	25.0	17.1	57.9	SCL	t
P42-1	0-17	5.7	54	35.6	28.7	35.7	SIC	t
-2	17-34	5.6	71	61.6	16.7	21.7	C	t
-3	34-60	5.0	68	54.0	12.4	33.6	C	t
-4	60-80	4.8	67	52.3	10.0	37.7	C	t
P46-1	0-15	5.4	48	21.0	24.4	54.6	SCL	t
-2	15-35	5.8	88	63.0	14.7	22.2	C	t
-3	35-95	5.8	100	67.0	15.1	17.9	C	t

Note: n.d. --- not determined; t --- trace.

TABLE D.3.8 RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES (B-I-1)

Sample No.	Organic Carbon (%)	Organic Matter (%)	Exchangeable Cations (me/100 g)					CEC (me/100g)	Base Saturation (%)
			Na	K	Ca	Mg	Total		
P2 -1	20.7	39.3	1.37	0.69	42.0	12.6	56.7	74.0	77
-2	2.30	4.4	0.32	0.18	22.7	12.4	35.6	70.0	51
-3	1.20	2.3	0.25	0.21	43.7	9.89	54.1	64.0	84
-4	3.90	7.4	0.27	0.19	41.2	13.2	54.9	64.0	86
P3 -1	1.20	2.1	0.25	0.54	19.3	18.4	38.5	56.0	69
-2	1.30	2.2	0.80	0.37	18.1	26.5	45.8	54.0	85
-3	0.39	0.7	0.99	0.40	24.7	22.7	48.8	49.6	98
-4	1.90	3.3	1.21	0.37	22.3	19.1	43.0	61.0	70
P7 -1	0.39	0.7	0.12	0.32	22.6	12.5	35.5	48.4	73
-2	0.88	1.5	0.14	0.21	21.0	6.69	28.0	36.6	77
-3	0.39	0.7	0.18	0.14	31.5	1.47	33.3	33.2	100
P8 -1	1.20	2.1	0.18	0.32	24.7	6.67	31.9	41.6	77
-2	0.27	0.5	0.18	0.21	19.3	14.2	33.9	38.6	88
-3	0.49	0.8	0.25	0.22	n.d.	n.d.	-	35.0	-
P9 -1	1.90	3.3	0.57	0.32	33.9	15.9	50.7	49.0	103
-2	1.60	2.8	0.47	0.19	31.0	12.5	44.2	43.2	102
-3	0.23	0.4	0.55	0.21	43.6	5.70	50.1	42.8	117
P14-2	30.4	57.7	1.42	0.24	43.6	5.70	51.0	86.6	59
-3	19.5	37.0	1.12	0.30	35.4	13.8	50.6	77.6	65
-4	18.3	34.1	2.42	0.47	38.7	17.0	58.6	80.0	73
P16-1	16.4	31.1	2.42	0.47	31.0	12.5	46.4	65.4	71
-2	17.6	33.4	3.00	0.44	54.5	1.90	59.8	68.2	88
-3	5.80	11.0	2.75	0.91	24.5	12.2	40.4	52.4	77
P18-1	1.70	2.9	0.11	0.21	n.d.	n.d.	-	33.0	-
-2	1.20	2.1	0.16	0.15	10.7	7.10	18.1	35.8	51
-3	1.40	2.4	0.08	0.19	9.90	9.40	19.6	48.0	41

Note: Organic matter (%) = Organic carbon (%) x 1.724 or x 1.897 (peat)

nd -- not determined; t --- trace.

TABLE D.3.8 RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES (B-I-2)

Sample No.	Organic Carbon (%)	Organic Matter (%)	Exchangeable Cations (me/100 g)					CEC (me/100g)	Base Saturation (%)
			Na	K	Ca	Mg	Total		
P21-1	1.90	3.3	0.37	0.47	35.9	9.00	45.7	51.0	90
-2	4.40	7.6	0.40	0.29	n.d.	n.d.	-	26.0	-
-3	0.93	1.6	0.22	0.18	n.d.	n.d.	-	26.0	-
P26-1	1.20	2.1	0.09	0.60	33.6	5.90	40.2	39.6	101
-2	1.20	2.1	0.08	0.29	32.9	2.45	35.7	37.6	95
-3	0.78	1.3	0.07	0.18	28.8	3.10	32.2	35.4	91
P30-1	25.3	48.0	0.77	0.40	45.6	20.4	67.2	96.6	70
-2	14.4	27.3	0.37	0.08	68.4	10.4	79.3	94.4	84
-3	23.4	44.4	0.47	0.15	68.8	20.0	89.4	95.0	94
P35-1	7.50	14.2	0.57	0.40	36.9	28.8	66.7	71.6	93
-2	28.9	54.8	2.25	0.25	25.5	24.8	52.8	74.6	71
-3	3.30	6.3	0.50	0.24	25.5	16.9	43.1	55.0	78
P38-1	16.7	31.7	2.08	0.24	24.3	7.92	34.5	35.0	99
-2	0.17	0.3	0.25	0.11	n.d.	n.d.	-	5.0	-
-3	0.19	0.4	0.27	0.11	n.d.	n.d.	-	5.0	-
-4	26.5	50.3	2.49	0.22	54.4	10.5	67.6	75.0	90
-5	3.30	6.3	0.77	0.21	16.3	4.10	21.4	22.0	97
P42-1	1.20	2.0	0.02	0.07	3.44	4.37	7.9	22.2	35
-2	0.82	1.4	0.02	0.02	4.37	5.18	9.6	19.4	49
-3	0.31	0.5	0.01	0.05	2.04	6.18	8.3	17.0	49
-4	0.14	0.2	0.02	0.04	2.22	4.29	6.6	16.0	41
P46-1	3.12	5.3	0.14	0.21	3.30	1.75	5.4	18.4	29
-2	0.57	1.0	0.37	0.11	4.40	0.96	5.8	20.0	29
-3	1.20	2.1	0.25	0.11	4.90	2.52	7.8	18.8	41

Note: Organic matter (%) = Organic carbon (%) x 1.724 or x 1.897 (peat)

nd -- not determined; t --- trace.

TABLE D.3.9 RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES (A-II)

Sample No.	Depth cm	pH (1:2.5)	Saturation %	Particle Size Distribution			Texture	CaCO ₃ %
				Clay %	Silt %	Sand %		
P55-1	0-14	4.8	n.d.	n.d.	n.d.	-	t	
-2	14-31	4.9	n.d.	n.d.	n.d.	-	t	
-3	31-49	4.7	n.d.	n.d.	n.d.	-	t	
-4	49-134	4.8	n.d.	n.d.	n.d.	-	t	
P57-1	0-6	4.0	n.d.	n.d.	n.d.	-	t	
-2	6-24	4.0	n.d.	n.d.	n.d.	-	t	
-3	24-35	4.8	n.d.	n.d.	n.d.	-	t	
-4	35-93	5.1	69	14.3	35.7	C	t	
P63-1	0-23	6.2	53	28.7	31.0	C	33.2	
-2	23-41	6.8	52	34.0	25.7	C	59.0	
-3	41-56	7.0	45	38.3	25.7	SIC	76.0	
-4	56-100	7.2	50	38.3	21.7	SIC	89.4	
P67-1	0-11	7.2	50	36.3	29.7	Sic	t	
-2	11-23	7.2	53	38.3	19.7	SICL	t	
-3	23-39	7.2	68	50.3	15.7	C	3.20	
-4	39-90	7.3	60	50.3	23.7	C	t	

TABLE D.3.10 RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLES (B-II)

Sample No.	Organic Carbon (%)	Organic Matter (%)	Exchangeable Cations (me/100 g)							CEC (me/100g)	Base Saturation (%)
			Na	K	Ca	Mg	Total				
P55-1	7.00	13.3	0.34	0.22	21.7	18.3	40.6	64.6	63		
-2	6.00	11.4	0.15	0.18	35.4	15.4	51.1	60.0	85		
-3	23.0	43.6	0.20	0.11	31.3	21.4	53.0	84.0	63		
-4	9.70	18.4	0.29	0.15	25.3	19.2	44.9	72.0	62		
P57-1	23.0	43.6	0.47	0.16	10.7	13.6	24.9	100.0	25		
-2	23.0	43.6	0.15	0.22	14.1	2.39	17.0	92.0	19		
-3	20.3	38.5	0.50	0.32	44.3	11.7	56.8	96.0	59		
-4	4.40	7.6	0.18	0.13	17.0	16.8	34.1	46.0	74		
P63-1	3.30	5.7	0.02	0.04	n.d.	n.d.	-	32.8	(>100)		
-2	2.00	3.4	0.02	0.04	n.d.	n.d.	-	28.6	(>100)		
-3	1.10	1.9	0.11	0.03	n.d.	n.d.	-	21.0	(>100)		
-4	0.31	0.5	0.04	0.03	n.d.	n.d.	-	18.0	(>100)		
P67-1	1.30	2.2	0.08	0.18	n.d.	n.d.	-	31.0	-		
-2	1.20	2.0	0.08	0.25	n.d.	n.d.	-	32.8	-		
-3	1.30	2.2	0.14	0.15	n.d.	n.d.	-	38.0	-		
-4	1.30	2.2	0.15	0.13	25.0	15.0	40.3	39.2	103		

Note: Organic matter (%) = Organic carbon (%) x 1.724 or x 1.897 (peat)
n.d. - Not determined, in case of P63 due to supersaturation with bases.

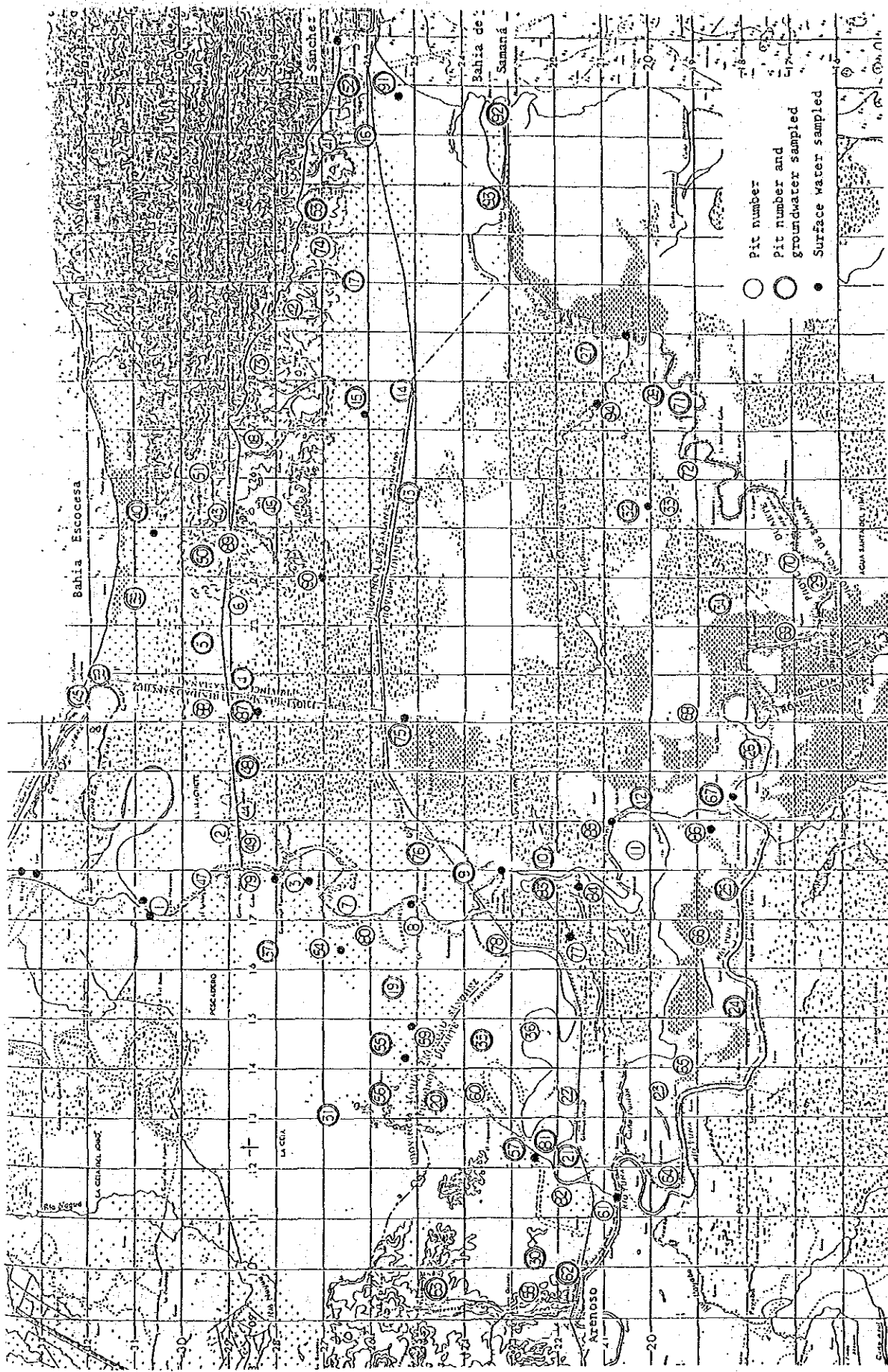


FIG. D.3.1 SITES OF SOIL PITS AND WATER SAMPLING

Scale 1:110,000

4. Soil Classification

Soils are classified mainly based on concepts of soil formation. However, the classification procedures varied widely because of different methods of interpreting soil profile data with relief, climate and geology in terms of the distribution of major soil groups.

Although not all the countries have created their own methods, most of them have adopted one of the representative methods of soil classification developed by advanced countries.

The Dominican Republic has recently applied the method of the United States Department of Agriculture (USDA). Historical outlines on the soil survey of the study area are introduced below.

4.1 Classification in Higher Categories

4.1.1 Map of Soil Associations (SEA)

The first soil survey of Valle del Cibao at a reconnaissance level was conducted by the staff of SEA from 1965 to 1967. The map of soil associations was made at the scale of 1:250,000. Fig. D.4.1 is a map of the area around the study area, excerpted from "Atlas Geologico y Mineralogico" which was compiled by R. Zoppis (1969). These associations seem to correspond to soil order level. In view of the present results obtained by the study team, extents of 3-24 (sandy soil with permeable layer, sabanna) and 36-40 (non calcareous clayey soil) are not favourable for agriculture as mentioned questionable in the succeeding chapter. Those of organic soils (peat) do not also reflect the actual status.

4.1.2 Soil Map of the World (FAO/UNESCO)

In 1972, FAO/UNESCO Soil Map of the World Project published a map sheet of Mexico and Central America (Vol. III). Since the map was prepared at the scale of 1:5,000,000, part of Dominica was magnified twice as shown in Fig. D.4.2. This classification has a system of soil group -

soil unit which is generally comparable to that of soil order - greater group. To cover all soils in the world, the soil units have been defined in terms of measurable and observable properties, which are combined into so-called "diagnostic horizons".

The study area consists of three soil units with associated soils and inclusions as shown below:

Soil Unit	Map Symbol	Associated Soil ($\geq 20\%$)	Inclusion ($< 20\%$)
Eutric Fluvisol	Je44-2a	Humic Gleysol Calcaric Fluvisol Pellic Vertisol	Thionic Fluvisol Eutric Planosol
Mollic Gleysol	Gm11-2a	Eutric Regosol Pellic Vertisol	Eutric Histosol
Eutric Planosol	We15-3a	Eutric Gleysol Ferric Luvisol Plinthic Luvisol	Mollic Gleysol

Distribution of soil units are largely comparable to the former map (Fig. D.4.1) because the soil identification might be based on the survey

data before 1972. Accordingly, some discrepancies in interpretation of soils and their extents are inevitable with less information as well as worldwide scale of the map. As compared with the latest results of soil survey, distinct differences in soil occurrence can be pointed as follows:

- 1) Je44-2a area should associate with Histosol but probably not include Thionic Fluvisol.
- 2) Gm11-2a area also associate Dystric Cambisol on mountainous slopes; the relief notation should be "abc" (level to steeply dissected).

4.1.3 Semi-detailed Soil Map, SEA/FAO

Formal soil survey on Valle del Cibao was initiated by P.L. Arens et al. in 1974 in cooperation with UNDP/FAO. The project continued to 1975 to cover all of the level plains, and in 1976 a semi-detailed soil map of Rio Yuna Valley was published at the scale of 1:50,000.

Fig. D.4.3 presents the distribution of soil order - suborder classified by USDA method. Soils prevailing on unsurveyed areas of piedmont and monadnock have been supplemented with the results obtained this time. The hectarage of each soil group is as follows:

Soil Order	Suborder	Area (ha)	Percentage (%)
Vertisol	Udert	1,690	7.0
Inceptisol	Acuept	1,000	4.1
	Tropept	4,240	17.6
	Sub-total	5,240	21.7
Molisol	Acuol	490	2.0
	Udol	2,390	10.0
	Sub-total	2,880	12.0
Alfisol	Acualf	550	2.3
Histosol	Fibrist	1,985	8.2
	Hemist	7,960	33.0
	Saprist	85	0.4
	Sub-total	10,030	41.6
Associations	-	3,650	15.2
Lagoons	-	60	0.2
Total	-	24,100	100.0

Histosol has the greatest extent followed by Inceptisol and Molisol. Since Histosol dominates in every association area, it would occupy approximately 60 percent of the entire area. Moreover when added with histic groups in the other soil orders, it is obvious how broad the organic soils have been developing in the study area.

Formation of these soil orders can be illustrated from view point of soil genesis. Fig. D.4.4 is drawn to show relationships among them in terms of topography and mother materials.

4.2 Classification in Lower Categories

Lower categories such as soil group, soil family and series are discussed hereinafter. These are defined step by step with diagnostic horizon, soil texture, mineral composition and temperature. To avoid complexity, soil series are mainly described hereinafter in relation to soil orders.

4.2.1 Soil Series Identified and Established in the Study Area

The former soil survey conducted by SEA/FAO (1974-1975) established 44 soil series within the study area. The present survey has checked and identified these series and found some sites where the soil profiles do not coincide with those described in the former report. The results are outlined in Tables D.4.1 and D.4.2 together with 4 series newly established in this time on the areas not yet surveyed in the past.

Totally 48 soil series are listed taxonomically in Table D.4.3 with 14 soil associations. Explanations for new soil series are referred in the latter paragraph. With these results the semi-detailed soil map above-mentioned has been revised more or less but at a minimum because pit observations were not enough in number. Boundary and name soil series except for new ones were changed of Pa, EG, Mu, Mo, ERi, PN, LCr, Be, MS, EAg and Na.

A new map of soil series has been thus delineated and presented in Fig. D.4.5. Table D.4.4 shows distribution of these series in terms of topography division which is compared to Fig. D.4.4. The hectareage of each series is given in Table D.4.5.

4.2.2 Typical Soil Profiles of Soil Series

Typical soil profiles for formal description were selected from the pit observations carried out in this time. These were also subjected to both field and laboratory analyses, results of which were already given from Table D.3.3 to Table D.3.10.

Descriptions of these soil profiles are arranged in the order shown below, but exclude those of new soil series:

Soil Order	Soil Series-Pit No.
Vertisol	Pa-P3, CA-P21
Inceptisol	AS-P2, MU-P16, LYa-P38, LCo-P67
Molisol	ERi-P9, PN-P35, RM-P7
Histosol	MOch-P14, Be-P57, EAg-P30, Na-P55

Descriptions of the other soil series are referred from the original soil report of SEA/FAO (1976). Fig. D.4.6 (1-4) presents the columnar profiles of all soil series which will help to understand their characteristics.

PROFILE No. P3

I. Information on the Site

- a. Profile No. : P3
- b. Soil Name : Vertisol, Cromudert, acuéntico,
familia arcillosa fina,
montmorilonitica/mixta,
isohipertérmica ; Simbolo: Pa
- c. Date of Examination : August 22, 1985
- d. Location : Rincón Molinillo. 100 m west of
the road from Nagua to Aguacate.
About 1.5 Km south of the
junction of Samana national road
at Cruce de Rincón
- e. Elevation : 1.5 m
- f. Land Form and Slope : Almost flat, very gently sloping
from west to east (0 - 1%).
- g. Vegetation and Land-use: Pit was dugged up on grassy part
beside the paddy field which was
being prepared for rice
cultivation.

II. General Information on the Soil

- a. Parent Material : Clayey alluvium of old Rio Yuna
and a few peat
- b. Drainage : Well drained
- c. Depth of Groundwater : 113 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None

Note: In profile description, figures in parenthesis which are put
after compactness are index values obtained by soil hardness
tester.

III. Profile Description

- A 0-10 cm Dark grayish brown (10YR4/2) moist and grayish brown (10YR5/2) dry, clay; strong fine angular blocky; very sticky, friable (3) moist; many fine surface cracks at every 5 - 10 cm width; many yellow brown mottles; many fine roots; clear smooth boundary; pH 4.50 (Sample No. P3-1)
- B 10-47 cm Gray (5Y5/1) moist and grayish brown (10YR5/2) dry, clay; massive with large cracks at every 30 cm width; very sticky, hard (13) moist; many brown mottles (5YR3/6); common fine roots; gradual smooth boundary; pH 5.66 (Sample No. P3-2)
- C 47-95 cm Grayish green (10BG5/1) with grayish olive (10Y3/2) parts, moist and grayish yellow (2.5Y6/3) dry, clay; massive with large cracks; very sticky, hard (12) moist; few reddish brown mottles; few fine roots; clear smooth boundary; pH 7.73 (Sample No. P3-3)
- IIC 95-130 cm Grayish olive green (2.5GY4/1) moist and grayish olive (2.5Y4/1) dry, clay; weak platy with thin hemic peat layer about 1 cm thick alternatively; very sticky, hard (16) wet; no mottle; no root; gradual smooth boundary; pH 6.14 (Sample No. P3-4)
- IIIC 130-165 cm Dark grayish olive (7.5Y2/1) wet, silt loam; weak medium platy; slight sticky, hard (14) wet; common thin fibric peat layer alternatively; clear smooth boundary
- IVC 165-200+cm Very similar to horizon above but grayish green (10BG5/1) wet, clay; very sticky
Very prompt reaction of ferrous iron throughout profile, but none of carbonate and manganese.

PROFILE No. P21

I. Information on the Site

- a. Profile No. : P21
- b. Soil Name : Vertisol, Cromudert ácuico,
familia arcillosa,
montmorillonitica,
isohipertérmica; Simbolo: CA
- c. Date of Examination : August 28, 1985
- d. Location : Cienega Vieja I. About 300 m
southeast of the road from Nagua
to Arenoso. 1.2 Km northeast
from junction with road along Rio
Yuna.
- e. Elevation : 7.4 m
- f. Land Form and Slope : Almost flat, very gently sloping
toward north (0 - 1%).
- g. Vegetation and Land-use: Grass land for pasture. Grasses
are composed of graminae, mainly
Caguai (local name). Adjacent to
corn field and wild forests.

II. General Information on the Soil

- a. Parent Material : Fine clayey alluvium of Rio Yuna.
- b. Drainage : Moderately well drained
- c. Depth of Groundwater : 70 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : Almost

III. Profile Description

- Ap 0-6 cm Very dark brown (10YR2/3) moist and brown (10YR5/3) dry, clay; strong fine subangular blocky with narrow cracks; very sticky, slightly hard (12) moist; no mottle; many fine roots; clear smooth boundary; pH 6.56 (Sample No. 21-1)
- B2 6-23 cm Very dark gray (10YR3/1) moist and brown (10YR5/3) dry, clay; strong medium angular blocky with few narrow cracks every about 40 cm and clear slickensides; very sticky, hard (17) moist; common dark brown mottles; few to common fine roots; gradual smooth boundary; pH 7.13 (Sample No. 21-2)
- C1 23-46 cm Dark gray (5Y4/1) moist and grayish brown (2.5Y5/3) dry, clay; strong medium subangular blocky with clear slickensides; very sticky, hard (17) moist; common slight yellowish brown mottles; almost no root; gradual smooth boundary; pH 7.68 (Sample No. 21-3)
- C2 46-130 cm Light olive brown (2.5Y4/1) moist, clay; weak coarse platy with moderately clear slickensides; very sticky, hard moist; common slight yellowish brown mottles; no root.
Only weak reaction of manganese throughout profile.

PROFILE No. P2

I. Information on the Site

- a. Profile No. : P2
- b. Soil Name : Inceptisol, Tropacuept histico, familia limosa fina a arcillosa, écuica, mixta, isohipertérmica; Simbolo: AS
- c. Date of Examination : August 22, 1985
- d. Location : Cruce Rincón. 200 m north of the national road from El Pozo to Sanchez. Approximately 0.8 Km east of Cruce Rincón corner.
- e. Elevation : 2.2 m
- f. Land Form and Slope : Almost flat marshy area, very slightly sloping toward north (0 - 1%) about 1 Km from pit
- g. Vegetation and Land-use: Well growing grass land, mainly consisting of gramineae species, about 1 m high.

II. General Information on the Soil

- a. Parent Material : Clayey alluvium of old Rio Yuna and peat material
- b. Drainage : Very poorly drained
- c. Depth of Groundwater : Almost same level as soil surface
- d. Presence of Surface Stones, Others : None
- e. Evidence of Erosion : None at site

III. Profile Description

- O11 0-26 cm Very dark brown (10YR2/2) wet and very dark grayish brown (10YR3/2) dry, fibrous peat with decayed timbers; no structure; non-sticky, soft (6) moist; no mottle; many fine roots; abrupt smooth boundary; pH 5.60 (Sample No P2-1)
- O12 26-42 cm Very dark brown (10YR2/2) wet and black (10YR2/1) dry, sandy clay with hemic peat and decayed timbers; no structure; no mottle; slightly sticky and loose (5) wet; no reaction of carbonate and oxidized manganese but very prompt reaction of ferrous iron; few fine roots; gradual smooth boundary; pH 5.84 (Sample No. P2-2)
- IIC1 42-60 cm Grayish olive green (2.5GY4/1) wet and dark gray (10YR4/1) dry, clay with some hemic peat; massives; no mottle; sticky and slightly compact; almost no root; same reaction as above layer; gradual smooth boundary; pH 6.17 (Sample No. P2-3)
- IIC2 60-90+cm Grayish olive green (2.5GY5/1) wet and gray (10YR5/1) dry, clay with some hemic to sapric peat; no structure; no mottle; very sticky and compact; prompt ferrous iron reaction; pH 6.36 (Sample No. P2-4)

PROFILE No. P16

I. Information on the Site

- a. Profile No. : P16
- b. Soil Name : Inceptisol, Tropacuept histico,
familia arcillosa, no-ácida,
isohipertérmica.
Simbolo: MU
- c. Date of Examination : August 26, 1985
- d. Location : Los Mango de Sanchez. About 1.4
Km south of national road to
Samana. Approximately 2.2 Km
east of Sanchez Town. The site
is nearby the railway.
- e. Elevation : 1.5 m
- f. Land Form and Slope : Almost flat, very gently sloping
to southeast 1 Km from pit.
- g. Vegetation and Land-use: Grass land nearby rice field.
Main grass families are
Gramineae, Cyperaceae and
Leguminosae. Big Community of
Canutillo is characteristic in
the land.

II. General Information on the Soil

- a. Parent Material : Peats of fibrous grasses and
timbers, and alluvial clay
deposits
- b. Drainage : Imperfectly drained
- c. Depth of Groundwater : 70 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None

III. Profile Description

- Oi1 0-12 Dark brown (10YR3/3) moist and brown (10YR4/3) dry, clay with fibric peat; no structure; slightly sticky, loose (7) moist; common yellowish brown mottles; abundant fine roots; clear smooth boundary; pH 7.47 (Sample No. P16-1)
- Oi2 12-33 cm Very dark brown (10YR2/3) moist and very dark grayish brown (10YR3/2) dry, clay with fibric peats and decayed timbers; weak coarse platy; slightly sticky, slightly compact (13) moist; common coarse clay blocks; no mottle; few fine roots; abrupt smooth boundary; pH 6.68 (Sample No. P16-2)
- IIC 33-170+cm Very dark gray (10YR3/1) moist and grayish brown (2.5Y5/2) dry, silty clay with few to common sapric peat blocks; no structure; very sticky, compact (18) moist; strong reaction of ferrous iron; no root; pH 6.54 (Sample No. P16-3)

PROFILE No. P38

I. Information on the Site

- a. Profile No. : P38
- b. Soil Name : Inceptisol, Eutropept tipico,
familia franca mixta, no ácida,
isohipertérmica;
Simbolo: LYa
- c. Date of Examination : September 2, 1985
- d. Location : Caño Gran Estero. About 30 m
south of the road along Bahía
Escocesa. Approximately 1.2 Km
east of the Caño mouth.
- e. Elevation : 2 m
- f. Land Form and Slope : Almost flat, very gently sloping
towards south about 500 m from
pit. Recent terraces developed
along sea coast.
- g. Vegetation and Land-use: Grass land not used, of Gramineae
and Leguminosae.

II. General Information on the Soil

- a. Parent Material : Coarse alluvium deposits of old
Rio Yuna and sea
- b. Drainage : Poorly drained
- c. Depth of Groundwater : 90 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None

III. Profile Description

Oe	0-9 cm	Very dark grayish brown (10YR3/2) moist and dark grayish brown (10YR4/2) dry, hemic peat; no structure; non-sticky, friable (5); no mottle; many fine roots; abrupt smooth boundary; pH 8.22 (Sample No. P38-1)
B1	9-21 cm	Grayish olive (7.5 Y4/2) moist and olive gray (5Y5/2) dry, sand; single granular; non-sticky, soft (7) moist; no mottle; almost no root; abrupt smooth boundary; pH 8.94 (Sample No. P38-2)
B2	21-41 cm	Very similar to horizon above, but gray (5Y4/1) moist and olive gray (5Y5/2) dry; pH 8.88 (Sample No. P38-3)
Oe	41-52	Very dark brown (10YR2/2) moist and dark grayish olive (2.5Y2/2) dry, sandy loam, hemic peat; no structure; non-sticky, slightly hard (10) moist; abrupt smooth boundary; pH 7.12 (Sample No. P38-4)
IIB	52-145+cm	Grayish olive (2.5Y4/2) moist and grayish brown (2.5Y5/2) dry, sandy clay loam; single granular; non-sticky, hard wet; pH 7.55 (Sample No. P38-5)

Reaction of carbonate was visible throughout profile, especially strong in second, third and last horizons. Reaction of ferrous iron increased with increase in depth.

PROFILE No. P67

I. Information on the Site

- a. Profile No. : P67
- b. Soil Name : Inceptisol, Tropept-Eutropept
fluvacuéntico, familia franca
fina, mixta, isohipertérmica;
Símbolo: LCo
- c. Date of Examination : December 10, 1985
- d. Location : Cruce la Cabirma, Guayabo. 100 m
north of Rio Yuna road.
Approximately 300 m north west of
junction at Cabolla with the road
from Rincón Molinillo.
- e. Elevation : 6.6 m
- f. Land Form and Slope : Flat. The land very gently
slopes toward northeast about 2
Km from pit.
- g. Vegetation and Land-use: Idle paddy field with abundant
gramineae grasses (Braquiaria) in
good growth status.

II. General Information on the Soil

- a. Parent Material : Fine alluvial particles
transported by Rio Yuna.
- b. Drainage : Imperfectly drained
- c. Depth of Groundwater : 80 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : Almost none

III. Profile Description

Ap	0-11 cm	Grayish olive (7.5Y4/1) and dark grayish brown (2.5Y4/2) moist, and brown (10YR4/3) dry, silty clay; weak coarse angular blocky with frequent surface cracks; very sticky and very hard (20) moist; no mottle; common fine roots; clear smooth boundary; pH 8.21 (Sample No. P67-1)
A2	11-23 cm	Dark grayish brown (10YR4/2) moist and light yellowish brown (10YR6/4) dry, silty clay loam; weak coarse angular blocky; very sticky and very hard (18) moist; common brownish mottles; few fine roots; gradual smooth boundary; pH 8.07 (Sample No. P67-2)
B1	23-39 cm	Very similar to above horizon but brown (10YR4/3) moist, clay; very hard (20) moist; almost no root; abrupt smooth boundary ; pH 8.13 (Sample No. P67-3)
B2	39-90 cm	Very similar to above horizon but moderate fine granular; hard (16) moist; many reddish brown mottles; abrupt smooth boundary; pH 7.90 (Sample No. P67-4)
IIC	90-150 cm	Brown (10YR4/3) moist, sandy loam; massives not sticky and slight compact wet; abrupt smooth boundary.
IIIC	150-170cm+	Almost similar to above horizon but loamy sand.

Strong reaction was only detectable in surface horizon with ferrous iron reagent.

PROFILE No. P9

I. Information on the Site

- a. Profile No. : P9
- b. Soil Name : Molisol
Argiacuol vértico, familia
arcillosa fina, mixta,
isohipertérmica;
Símbolo: ERi
- c. Date of Examination : August 23, 1985
- d. Location : Molinillo. 20 m south of old
railway. About 1.2 Km northeast
of Rincón Molinillo.
- e. Elevation : 3.8 m
- f. Land Form and Slope : Flat, very gently sloping toward
east (0 - 1%)
- g. Vegetation and Land-use: Grass land, mainly consisting of
gramineae and cyperaceae species.
Adjacent fields were planted for
rice.

II. General Information on the Soil

- a. Parent Material : Clayey alluvium of old Rio Yuna.
- b. Drainage : Imperfectly drained
- c. Depth of Groundwater : 57 cm from surface
- d. Presence of Surface Stones, Others
: None at site
- e. Evidence of Erosion : None

III. Profile Description

- A 0-8 cm Dark yellowish brown (10YR3/4) moist and brown (10YR4/3) dry, clay, covered with residual plant mat 2 cm thick (not sampled); weak medium subangular blocky; very sticky, soft (7) moist; common yellowish brown mottles; many fine roots; clear smooth boundary; pH 6.49 (Sample No. P9-1)
- B 8-30 cm Very dark grayish brown (10YR3.5/2) moist and dark grayish brown (10YR4/2) dry, clay; weak medium subangular blocky; very sticky, hard (12); many reddish brown mottles; common fine roots; clear smooth boundary; pH 6.99 (Sample No. P9-2)
- C 30-161+cm Grayish green (10GY5/1) and grayish olive (10Y5/2) moist, and brown (10YR5/3) dry, clay; almost massive; very sticky, hard (12) moist; common fine dark reddish brown mottles (5YR2/4); no roots; pH 8.31 (Sample No. P9-3)

Manganese reaction was clear to weak from surface to last horizon, while strong reaction of ferrous iron was observed throughout profile.

PROFILE No. P35

I. Information on the Site

- a. Profile No. : P35
- b. Soil Name : Molisol, Haplacuel histico,
familia arcillosa fina, mixta
isohipertérmica.
Símbolo: PN
- c. Date of Examination : August 30, 1985
- d. Location : El Pelao, El Aguacate. 50 m east
of the road from El Aguacate
junction. Approximately 2 Km
east of El Aguacate.
- e. Elevation : 4.8 m
- f. Land Form and Slope : Almost flat, very gently sloping
towards south (0 - 1%).
- g. Vegetation and Land-use: Rice field under preparation for
planting.

II. General Information on the Soil

- a. Parent Material : Fibrous peat and clayey alluvium
of old Rio Yuna
- b. Drainage : Moderately well drained
- c. Depth of Groundwater : 74 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None

III. Profile Description

- Oa1 0-8 cm Black (10YR2/1) moist and very dark grayish brown (10YR3/2) dry, sapric peat and silty clay loam; strong fine granular; slightly sticky, friable (6) moist; no mottle; many fine roots; clear smooth boundary; pH 5.72 (Sample No. P35-1)
- Oe2 8-17 cm Black (10YR2/1) moist and dark grayish brown (10YR4/2) dry, hemic peat and clay; weak coarse subangular blocky; slightly sticky, soft (7) moist; few dark brown mottles; few fine roots; abrupt smooth boundary; pH 5.72 (Sample No. P35-2)
- IIC 17-107+cm Grayish olive green (7.5GY5/1) moist and dary gray (5Y4/1) dry, clay with some fibric peat; no structure (massive); very sticky, compact (18) moist; common brown mottles; few decayed timbers; strong reaction of ferrous iron, almost no root; pH 5.92 (Sample No. P35-3)

PROFILE No. P7

I. Information on the Site

- a. Profile No. : P7
- b. Soil Name : Molisol, Hapludol típico, familia franca fina, mixta, isohipertérmica; Simbolo: RM
- c. Date of Examination : August 23, 1985
- d. Location : San Rafael, Rincón Molinillo. 70 m east of the road from Nagua to R.Molinillo. About 2.5 Km south of the junction of Samana road at Cruce de Rincón.
- e. Elevation : 2.5 m
- f. Land Form and Slope : Almost flat, very gently sloping toward south.
- g. Vegetation and Land-use: Cacaos, 50 years old, shadowed by tall natural trees (Jabilla).

II. General Information on the Soil

- a. Parent Material : Alluvium of old Río Yuna.
- b. Drainage : Well drained
- c. Depth of Groundwater : Unknown but certainly more than 1.5 m, no influence on profile
- d. Presence of Surface Stones, Others : None at site
- e. Evidence of Erosion : None

III. Profile Description

- A1 0-7 cm Dark grayish brown (7/5YR2/2) moist and brown (10YR4/3) dry, clay; moderate fine granular; sticky, friable (9) moist; no mottle; slight hemic; common fine roots; clear smooth boundary; pH 6.6 (Sample No. P7-1)
- A2 7-46 cm Dark brown (10YR3/3) moist and yellowish brown (10YR4/3) dry, sandy loam; moderate coarse subangular blocky; sticky, very hard (18) moist; few yellowish brown mottles; many slickensides; few to common fine roots; gradual smooth boundary; pH 6.8 (Sample No. P7-2)
- IIC 46-93 Dark yellowish brown (10YR4/4) moist and yellowish brown (10YR5/4) dry, clay loam; moderate coarse blocky or massive; very sticky, extremely hard (23) moist; many yellowish brown mottles; no root; gradual smooth boundary; pH 6.9 (Sample No. P7-3)
- IIIC 93-162+cm Dark yellowish brown (10YR3/4) moist, sandy loam; massive; non sticky, very hard moist; common mottles.

Only slight reaction of manganese throughout profile

PROFILE No. P14

I. Information on the Site

- a. Profile No. : P14
- b. Soil Name : Histosol, Trophemist, familia
eúica, isohipertérmica;
Símbolo: MOch
- c. Date of Examination : August 26, 1985
- d. Location : Milla Cinco, Sanchez. 20 m north
of the old railway.
Approximately 7.2 Km west of
Sanchez Town along the railway.
- e. Elevation : 1.3 m
- f. Land Form and Slope : Almost flat, gently sloping
towards north about 2 Km from
pit.
- g. Vegetation and Land-use: Grass land with developing peat.
Grasses are composed of tall
gramíneae, Cyperaceae and
Alismataceae species.

II. General Information on the Soil

- a. Parent Material : Peat developed on old lagoon
inside of Bahía Samana,
consisting mainly of fibrous
grass materials.
- b. Drainage : Very poorly drained
- c. Depth of Groundwater : 0 cm, same level as peat surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None

III. Profile Description

Oi1	0-10 cm	Very dark brown (10YR2/3) wet and very dark brown (10YR2/2) dry, fibric peat; no structure; non-sticky, friable wet; abundant fine to medium roots; clear smooth boundary (Not sampled)
Oe2	10-40 cm	Dark brown (6.5 YR2/1) wet and black (10YR2/1) dry, hemic peat; no structure; non-sticky, soft wet; many fine roots; clear smooth boundary; pH 5.77 (Sample No. P14-2)
Oi3	40-180 cm	Very similar to horizon above but fibric peat; many decayed roots; pH 5.84 (Sample No. P14-3).
Oi4	180-270 cm	Very similar to horizon above but very dark brown (10YR2/3) wet and very dark gray (10YR3/1) dry; no root; pH 5.32 (Sample No. P14-4).
IIC	270-300+cm	Dark gray (10YR4/1) wet, silty clay; massive; very sticky, compact;

Throughout profile no reaction of carbonate and manganese but apparent reaction of ferrous iron, the deeper the stronger.

PROFILE No. P57

I. Information on the Site

- a. Profile No. : P56
- b. Soil Name : Histosol Trophemist térrico,
familia eúica, isohipertérmica;
Símbolo: Be
- c. Date of Examination : December 6, 1985
- d. Location : Aguacate, Aguacate. 1 Km
southwest of Aguacate village.
50 m west of the road to Arenoso.
- e. Elevation : 7.4 m
- f. Land Form and Slope : Almost flat, very gently sloping
toward south (0 - 1%)
- g. Vegetation and Land-use: Grass land in very poor growth.
Rice fields are developed nearby.

II. General Information on the Soil

- a. Parent Material : Clayey alluvium of Rio Yuna and
peat
- b. Drainage : Poorly drained
- c. Depth of Groundwater : 65 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None

III. Profile Description

- | | | |
|-----|------------|---|
| Oe1 | 0-6 cm | Dark brown (7.5YR2/3) dry and very dark brown (10YR2/2) moist, hemic peat; non sticky, loose (6); no mottle; many fine roots; abrupt smooth boundary; pH 3.63 (Sample No. P57-1) |
| Oe2 | 6-24 cm | Very similar to horizon above but hemic peat; few fine roots; abrupt smooth boundary; pH 3.75 (Sample No. P57-2) |
| Oi3 | 24-35 cm | Dark yellowish brown (7.5YR3/4) dry and dark brown (7.5YR3/2) moist, fibric peat; non sticky, loose (8); no root; abrupt smooth boundary; pH 5.53 (Sample No. P57-3) |
| Cl | 35-93 cm | Dark gray (5Y4/1) dry and grayish olive (7.5Y3/1) moist, clay; massive; very sticky, slightly hard (12) moist; many red brown mottles (5YR4/6); gradual smooth boundary; pH 5.97 (Sample No. P57-4) |
| IIC | 93-115 cm | Grayish green (10GY4/1) moist, sandy clay loam; massive; sticky, slightly hard; no mottle; wavy smooth boundary (Not sampled) |
| Oe4 | 115-133 cm | Dark yellowish brown (7.5YR2/3) moist, hemic and fibric peat; non sticky, slightly hard; no mottle (Not sampled) |

Only ferrow iron was detected, the deeper horizon the stronger.

PROFILE No. P30

I. Information on the Site

- a. Profile No. : P30
- b. Soil Name : Histosol, Tropohemist tipico,
familia eúica, isohipertérmica;
Símbolo: EAg
- c. Date of Examination : August 29, 1985
- d. Location : Arenoso, Aguacate. 100 m east of
the Loma remanente, Arenoso.
Approximately 1 Km northeast of
Arenaso Twon.
- e. Elevation : 8 m
- f. Land Form and Slope : Almost flat, very gently sloping
towards east (0 - 1%) about 500 m
from pit.
- g. Vegetation and Land-use: Grass land with developing peat.
Grasses are composed of tall
Gramineae and Cyperaceae species
(Enea).

II. General Information on the Soil

- a. Parent Material : Peat of fibrous grass origin.
- b. Drainage : Very poorly drained
- c. Depth of Groundwater : 65 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None

III. Profile Description

- Oe1 0-23 cm Very darkbrown (10YR2/2) moist and very dark brown (10YR2/2) dry, hemic peat; weak coarse blocky; non-sticky, slightly hard (11) moist; many fine roots; gradual smooth boundary; pH 6.64 (Sample No. P30-1)
- Oe2 23-50 cm Very dark brown (10YR2/3) moist and black (10YR2/1) dry, hemic peat; weak coarse blocky; non-sticky, soft (7) moist; no mottle; few fine root; clear smooth boundary; pH 6.11 (Sample No. P30-2)
- Oi3 50-118 cm Dark yellowish brown (10YR3/4) moist and very dark brown (10YR2/2) dry, fibric peat; no structure; non-sticky; soft (7) wet; not root; pH 6.21 (Sample No. P30-3)
- IIC 118-130+cm Grayish olive green (7.5GY4/1) wet, clay; almost massive; very sticky. slight compact; no mottle; no root.

Only ferrous iron reaction was found below the third horizon.

PROFILE No. P55

I. Information on the Site

- a. Profile No. : P55
- b. Soil Name : Histosol Troposaprist térrico,
familia arcillosa, eúica,
isohipertérmica;
Símbolo: Na
- c. Date of Examination : December 6, 1985
- d. Location : El Pelao, Aguacate. 3 Km
northeast of Aguacate village.
300 m west of the road to Cruce
de Rincón.
- e. Elevation : 4.6 m
- f. Land Form and Slope : Almost flat, very gently sloping
toward east (0 - 1%)
- g. Vegetation and Land-use: Paddy field. Local variety,
Ingles in good growth, just
before heading.

II. General Information on the Soil

- a. Parent Material : Clayey alluvium of old Rio Yuna
and peat
- b. Drainage : Poorly drained
- c. Depth of Groundwater : 10 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None

III. Profile Description

- Oa1 0-14 cm Very dark grayish brown (10YR3/2) dry and black (10YR1.5/1) moist, silt loam; non structure and sapric peat; slightly sticky and loose (7) wet; no mottle; many fine roots; clear smooth boundary; pH 5.57 (Sample No. P55-1)
- Oa2 14-31 cm Dark yellowish brown (10YR3/4) dry and black (10YR2/1) moist, silt loam; non structure and sapric peat; slightly sticky and loose (8) wet; few fine roots; abrupt smooth boundary; pH 6.27 (Sample No. P55-2)
- C1 31-49 cm Very similar to horizon above but olive gray (5Y5/2) moist, clay; very sticky; no root; pH 5.98 (Sample No. P55-3)
- O14 49-134 cm Very dark grayish brown (10YR3/2) dry and very dark brown (10YR2/2) moist, loam; non structure and fibric peat; slightly sticky and soft; abrupt smooth boundary; pH 5.39 (Sample No. P55-4)
- IIC 134-150cm+ Grayish olive (10Y5/1) moist, clay; non structure; very sticky and slight compact (Not sampled)

Very strong reaction of ferrous iron with chemical reagent throughout profile, but non of carbonate and manganese.

4.2.3 Descriptions of New Soil Series

Four new soil series, Yab, LM, AB and ECa named after the site where each of them was first observed, were added to complete soil map of the study area.

These are soils developed on limestone and classified into Inceptisol since they do not have any decisive diagnostic horizon to be compiled in the other soil orders. All of them occur on the northeastern piedmont areas, Cordillera, and on the southwestern monadnocks, Yabacoa, whose geological origin is largely composed of limestones of tertiary miocene.

The soil profile differs each other due probably to the differences in mineral composition and progress of weathering under specific climatic condition. According to the results of survey and analysis, these soil series can be characterized as follows:

Soil Series	Texture		Diagnostic Horizon	pH	Base Saturation (%)
	(Upper) (30cm)	(Lower) (<30cm)			
Yab	SiCL-C	SiC	Mollic A horizon	8.0-8.8	> 50
LM	SiC-C	C*	Umbric A horizon	5.0-6.0	< 50
AB	SiCL-C	C	Cambic B horizon**	4.5-5.0	< 50
ECa	SL-SCL	L-C	Umbric A horizon	4.3-5.0	< 50

Note: * - With many debris of weathered limestone.

** - Occasionally with hard or soft manganese concretions.

Yab occurs on dissected hilly areas in high elevation more than 25 m, followed by LM and AB on lower undulating areas. ECa appearing on the lowest piedmont areas less than 20 cm in elevation is over-laid by sandy layer which is presumably alluvial origin transported in the past.

Although different in texture and reaction, the latter three series are commonly underlaid by thick clay horizon with many reddish brown mottles. Although the diagnostic horizons are not so distinct, Yab is classified in Eutropept tipico, and the other three series are grouped into Dystropept tipico.

Profile descriptions are arranged from the next page in the order below:

Yab: P63; LM: P18, P41; AB: P42; ECa: P43, P46, P50

Most of these profiles are supplemented with data of the laboratory analysis. (Refer to Tables D.3.7 - D.3.9.)

PROFILE No. P63

I. Information on the Site

- a. Profile No. : P63
- b. Soil Name : Inceptisol, Tropept-Eutropept
típico, familia franca fina,
isohipertérmica;
Símbolo: Yab
- c. Date of Examination : December 10, 1985
- d. Location : Yabacoa, Aguacate. 300 m east of
the road (Arrove Arenosito).
Approximately 3Km north of
Arenoso Village, Provincia
Duarte.
- e. Elevation : 25 m
- f. Land Form and Slope : Remnant hill sloping toward east
(about 25%) for 100 m. Pit was
made at the middle of hill.
- g. Vegetation and Land-use: Pasture dominantly with gramineae
grasses (Yabagua) in not so good
growth status

II. General Information on the Soil

- a. Parent Material : Weathered limestones, mudstones
and conglomerates of tertiary
- b. Drainage : Well drained
- c. Depth of Groundwater : Unknown but probably more than 5
m from surface
- d. Presence of Surface Stones, Others : Some pebbles of limestone and
mudstone
- e. Evidence of Erosion : Sheet erosion under heavy
rainfall

III. Profile Description

- A 0-23 cm Very dark grayish brown (2.5Y3/2) moist and very dark grayish brown (10YR3/2) dry, clay; strong fine subangular blocky; sticky and very hard (20) moist; no mottles many fine roots; clear smooth boundary; pH 8.18 (Sample No. P63-1)
- AB1 23-41 cm Dark grayish brown (2.5Y4/2) moist and grayish brown (2.5Y5/3) dry, clay; moderate medium subangular blocky; sticky and extremely hard (23) moist; common pale yellow mottles (2.5Y8/4); common fine roots; gradual smooth boundary; pH 8.42 (Sample No. P63-2)
- B2 41-56 cm Pale yellow (2.5Y8/4) and dark grayish brown (2.5Y4/2) moist, and light gray (2.5Y7/3) dry, silty clay; weak medium angular blocky; sticky and extremely hard (24) moist; few weathered small limestones (2 - 7 cm); few fine roots; gradual smooth boundary; pH 8.48 (Sample No. P63-3)
- C 56-100 +cm Pale yellow (2.5Y8/4) moist and pale yellow (2.5Y8/4) dry, silty clay; massive; common weathered limestones (5 - 10 cm); sticky and extremely hard (25); no root; pH 8.60 (Sample No. P63-4)

Throughout profile strong effervescence was observed with 10% HCl solution, and very weak reaction with manganese reagent.

PROFILE No. P18

I. Information on the Site

- a. Profile No. : P18
- b. Soil Name : Inceptisol, Tropept-Dystropept
tipico, familia arcillosa muy
fina, mixta isohipertérmica;
Símbolo: LM
- c. Date of Examination : August 26, 1985
- d. Location : La Majagua de Sanchez. 50 meters
south of the national road.
Approximately 9 Km west from
Sanchez, Samana Province.
- e. Elevation : 25 m
- f. Land Form and Slope : Undulating mountain foot. Land
slopes gently (2 - 6%) downward
to south about 20 m from pit.
- g. Vegetation and Land-use: Coconut and grass land, in fairly
good growth.

II. General Information on the Soil

- a. Parent Material : Apparently derived 'in situ' from
deeply weathered limestones.
(residium)
- b. Drainage : Moderately well drained
- c. Depth of Groundwater : Unknown, but certainly more than
2 m, no influence on profile.
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None at site, but slight sheet
erosion in adjacent area.

III. Profile Description

- A1 0-5 cm Yellowish brown (10YR4/4) moist and yellowish brown (10YR5/4) dry, clay; moderate medium subangular blocky; very sticky, hard (13) moist; no mottle; frequent fine root; clear smooth boundary; pH 6.0 (Sample No. P18-1)
- A2 5-8 cm Yellowish brown (10YR4/6) moist and brown (10YR5/3) dry, clay; moderate medium subangular blocky; very sticky, hard (17) moist; few yellowish mottles; common fine roots; clear smooth boundary; pH 6.0 (Sample No. P18-2)
- B2 8-70 cm Brownish yellow (10YR6/6) moist and yellow (10YR7/8) dry, clay; almost massive; very sticky, very hard (22) moist; many yellowish red (5YR5/6) mottles; few to no fine roots; clear smooth boundary; pH 5.3 (Sample No. P18-3)
- C 70-130 cm+ Yellow (10YR7/6) moist, clay; massive; very sticky, extremely hard (23) moist; few dark brown mottles (manganese); few small shell pieces (2 - 5 mm) and few black decayed organic matter; no root (Not sampled)

No visible effervescence with HCl solution except for shell pieces in C horizon.

PROFILE No. P41

I. Information on the Site

- a. Profile No. : P41
- b. Soil Name : Inceptisol Tropept-Dystropept
tipico, familia arcillosa muy
fina, mixta isohipertérmica;
Simbolo: LM
- c. Date of Examination : September 2, 1985
- d. Location : Los Mangos, Sanchez. 300 m south
of national road. Approximately
2.5 Km west from Sanchez, Samana
Province.
- e. Elevation : 23 m
- f. Land Form and Slope : Rolling hills. Land slopes
toward southwest (6 - 12%) about
50 m from pit.
- g. Vegetation and Land-use: Coconut field including few cacao
and plantains. Grasses consist
of Gramineae and Cyperaceae
species.

II. General Information on the Soil

- a. Parent Material : Presumably derived weathered
limestones
- b. Drainage : Well drained
- c. Depth of Groundwater : Unknown, but certainly more than
4 m, no influence on profile.
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : Slight gully erosion under heavy
rain fall in the wet season.

III. Profile Description

- A 0-13 cm Very dark brown (10YR2/2) moist and brown (10YR4/3) dry, silty clay loam; strong medium angular blocky; very sticky, hard (15) moist; no mottle; many fine roots; abrupt smooth boundary.
- B 13-25 cm Dark yellowish brown (10YR3/4) moist and yellowish brown (10YR5/5) dry, silty clay; weak coarse angular blocky; very sticky, very hard (20); no mottle; few fine roots; clear smooth boundary.
- C 25-89+cm Yellowish brown (10YR4/6) moist and very pale brown (10YR7/4) dry, clay; almost massive; very sticky, very hard (21) moist; no mottle but very weak manganese reaction with chemical reagent; almost no root.

PROFILE No. P42

I. Information on the Site

- a. Profile No. : P42
- b. Soil Name : Inceptisol Tropept-Dystropept
tipico, familia arcillosa,
concretiones de manganeso,
isohipertérmica;
Simbolo: AB
- c. Date of Examination : September 2, 1985
- d. Location : Agua Buena de Sanchez. 300 m
south of the national road.
Approximately 6 Km west from
Sanchez, Samana Province.
- e. Elevation : 23 m
- f. Land Form and Slope : Undulating hill slope. Land
slopes toward southwest (3 - 7%)
about 100 m from pit.
- g. Vegetation and Land-use: Coconut and grass land. Grasses
are mainly Gramineae, Cyperaceae
and Leguminosae species.

II. General Information on the Soil

- a. Parent Material : Apparently derived 'in situ' from
deeply weathered limestones.
- b. Drainage : Well drained
- c. Depth of Groundwater : Unknown, but certainly more than
4 m, no influence on profile.
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : None at site, but slight sheet
erosion in adjacent area.

III. Profile Description

- A 0-17 cm Reddish brown (5YR4/4) moist and yellowish brown (7.5YR4/6) dry, silty clay; strong fine granular; slight sticky, very hard (21) moist; no mottle, many spherical manganese concretions (4-5 mm); frequent fine roots; abrupt smooth boundary; pH 5.03 (Sample No. P42-1)
- B 17-34 cm Yellowish red (5YR4/8) moist, yellowish red (5YR5/8) dry, clay; moderate fine to coarse subangular blocky; very sticky, very hard (21); no mottle, common spherical manganese concretions (4-5 mm); few fine and medium roots; clear smooth boundary; pH 4.90 (Sample No. P42-2)
- C1 34-60 cm Reddish yellow (7.5YR6/8) and yellowish red (5YR4/8) moist, and reddish yellow (7.5YR6/8) dry, clay; massive; very sticky, very hard (22) moist; no mottle; no concretion; few medium root; clear smooth boundary; pH 4.45 (Sample No. P42-3)
- C2 60-80+cm Reddish yellow (7.5YR6/8) moist and reddish yellow (7.5YR6/8) dry, clay; massive; very sticky, very hard (22); common reddish brown mottles; no root; pH 4.44 (Sample No. P42-4)

No reaction with chemical reagents was detected throughout profile.

PROFILE No. P43

I. Information on the Site

- a. Profile No. : P43
- b. Soil Name : Inceptisol Dystropept tipico,
familia arenoso a franca, mixta,
isohipertérmica;
Símbolo: ECa
- c. Date of Examination : September 2, 1985
- d. Location : El Catey, Sanchez. 100 m north
of national road. Approximately
10.2 Km west from Sanchez, Samana
Province.
- e. Elevation : 18 m
- f. Land Form and Slope : Undulating hills. Land slopes
toward southwest (3 - 7%) about
50 m from pit.
- g. Vegetation and Land-use: Conconut field. Grasses are
mainly Gramineae and Cyperaceae
species.

II. General Information on the Soil

- a. Parent Material : Coarse alluvial deposits on
weathered limestone materials
- b. Drainage : Well drained
- c. Depth of Groundwater : Unknown but certainly more than
3m
- d. Presence of Surface Stones, Others : None
- e. Evidence of Erosion : Slight sheet erosion under heavy
rainfall in wet season.

III. Profile Description

- A1 0-15 cm Very dark grayish brown (10YR3/2) moist and brown (10YR5/3) dry, loamy sand; weak medium subangular blocky; not sticky, slightly hard (11) moist; no mottle but few black soil particles; many fine roots; clear smooth boundary
- A2 15-38 cm Dark yellowish brown (10YR3/4) moist and yellowish brown (10YR5/4) dry, loamy sand; weak medium subangular blocky, not sticky, hard (16) moist; no mottle; few fine and medium roots; clear smooth boundary.
- B2 38-59 cm Light yellowish brown (10YR6/4) moist and very pale brown (10YR7/4) dry, sandy loam; massive; not sticky, very hard (18) moist; no mottle; very few roots; abrupt smooth boundary.
- IIC 59-98+cm Yellow (10YR7/6) and brown (10YR5/3) moist and yellow (10YR8/6) dry, silty clay; massives; very sticky, very hard (22); many yellowish brown mottles; no root.

No visible reaction with chemical reagents throughout profile.

PROFILE No. P46

I. Information on the Site

- a. Profile No. : P46
- b. Soil Name : Inceptisol Dystropept típico,
familia arenosa a franca, mixta,
disica, isohipertérmica;
Símbolo: ECa
- c. Date of Examination : September 3, 1985
- d. Location : El Catey, Sanchez. About 1 Km
south of national road.
Approximately 10 Km west from
Sanchez, Samana Province.
- e. Elevation : 17 m
- f. Land Form and Slope : Undulating hills. Land slopes
towards northeast (2 - 5%) about
200 m from pit
- g. Vegetation and Land-use: Peanut field, growing moderately
good. Spraying weedicide
(Paraguay) on fallow field at
time of examination.

II. General Information on the Soil

- a. Parent Material : Coarse alluvial deposits on
weathered limestone materials.
- b. Drainage : Moderately well drained
- c. Depth of Groundwater : 83 cm from surface
- d. Presence of Surface Stones, Others
: None
- e. Evidence of Erosion : Slight sheet erosion under heavy
rainfall.