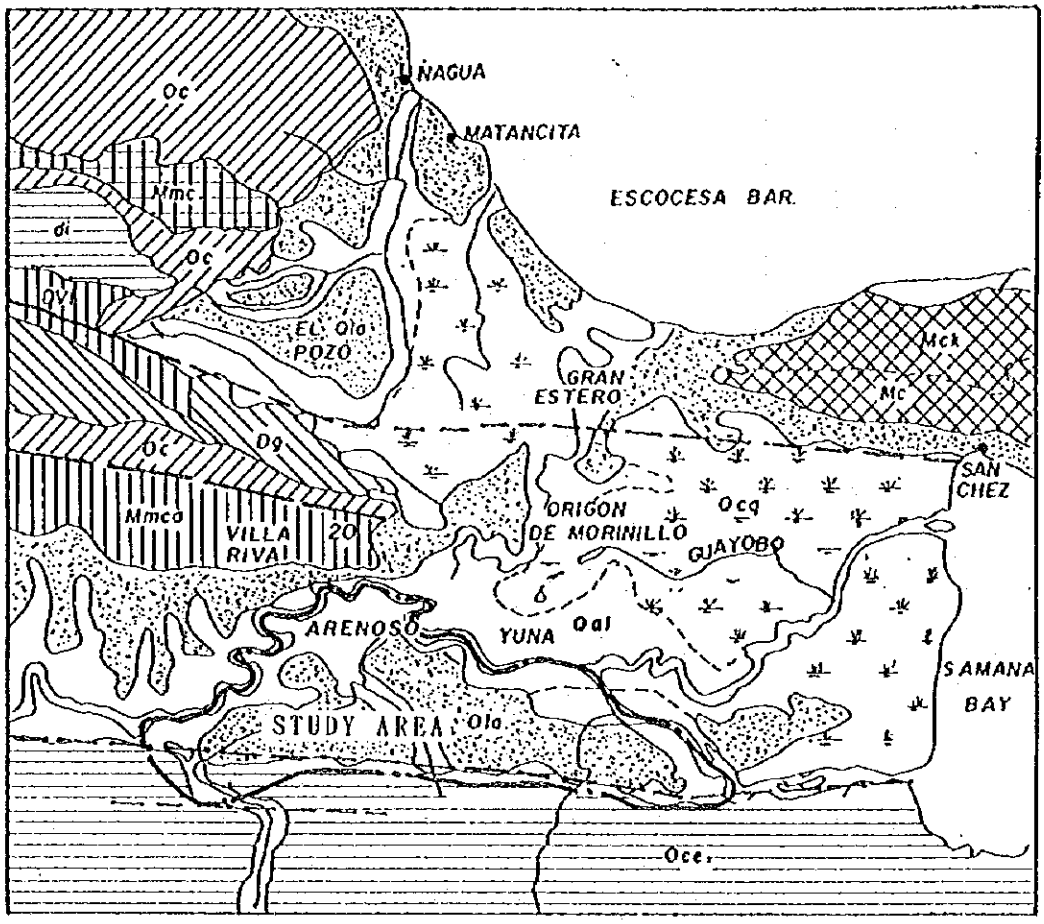
ANNEX C : FIGURES



GEOLOGY OF THE PROJECT AREA

QUATERNARY	RECENT		Qal	ALLUVIUM
			Qcg	MARSH
			Qla	LACUSTRINE AND MARINE DEPOSITS: PRINCIPALLY CLAY WITH SAND AND GRAVEL. THIN DEPOSITS FREQUENTLY OCCUR ABOVE BEACH LIMESTONE.
TERTIARY	MIOCENE INDIVISIBLE		Mck	LIMESTONE.
			Mc	LIMESTONE OF LAS ANGOSTURAS AND LAS SALINAS FORMATION.
	MIOCENE MIDDLE		Mmc	LIMESTONE.
			Mmca	LIMESTONE, MUDSTONE AND CONGLOMERATE OF LA GUABA FORMATION.
	OLIGOCENE INDIVISIBLE		Og	CONGLOMERATE OF LA TABELA FORMATION.
			Oce	LIMESTONE, CALCAREOUS SANDSTONE AND CLAYEY SLATE, FORM PART OF LAS SOMBRERITO FORMATION.
			Oc	LIMESTONE, FORMS PART OF LAS SOMBRERITO FORMATION.
PERIOD UNKNOWN			dvt	VOLCANIC ROCK, PRINCIPALLY TUFF.
			di	METAMORPHIC ROCK.

GEOLOGICAL SYMBOLS

——— FORMATION BOUNDARY

— — — FAULT, DASHED WHERE APPROXIMATELY LOCATED

Fig. C.3.1 Geological Map of Study Area

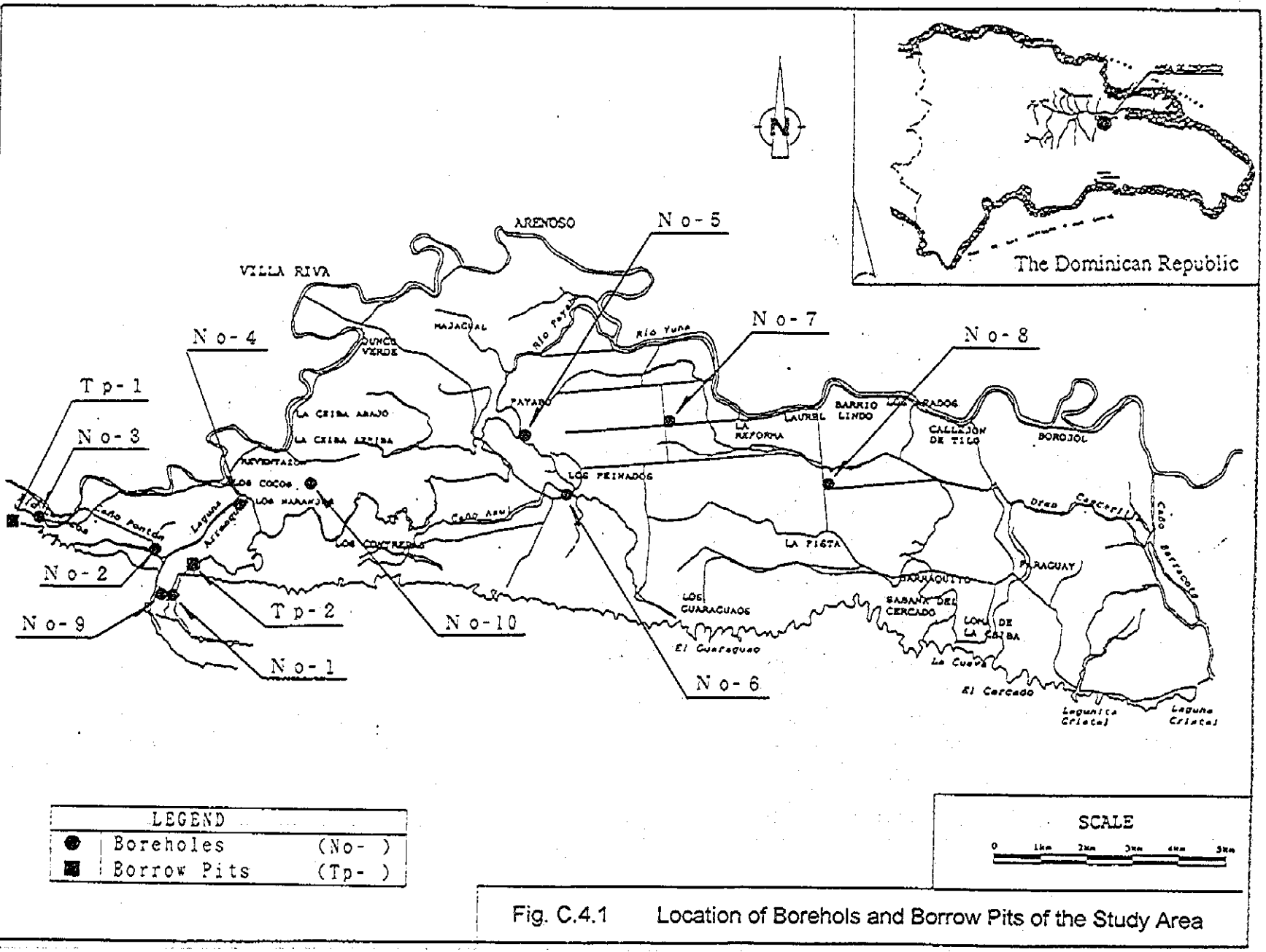
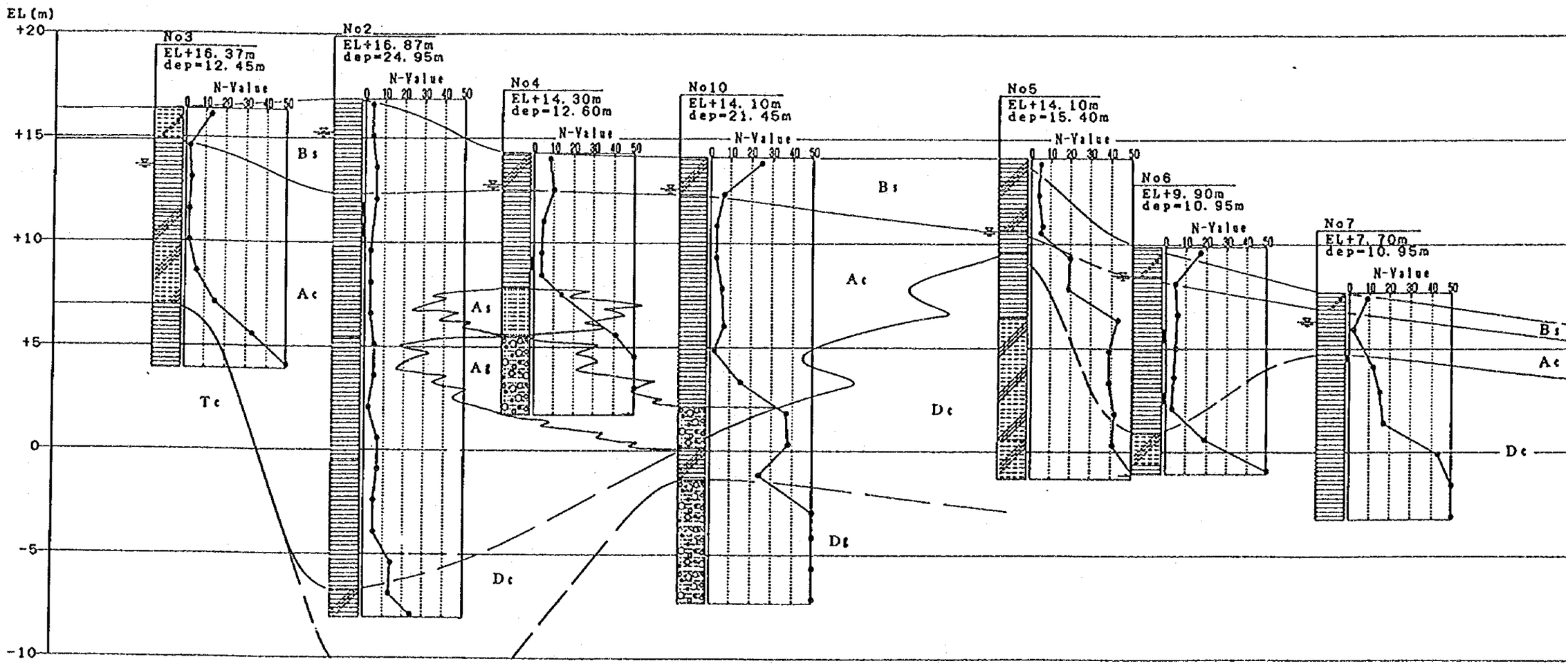


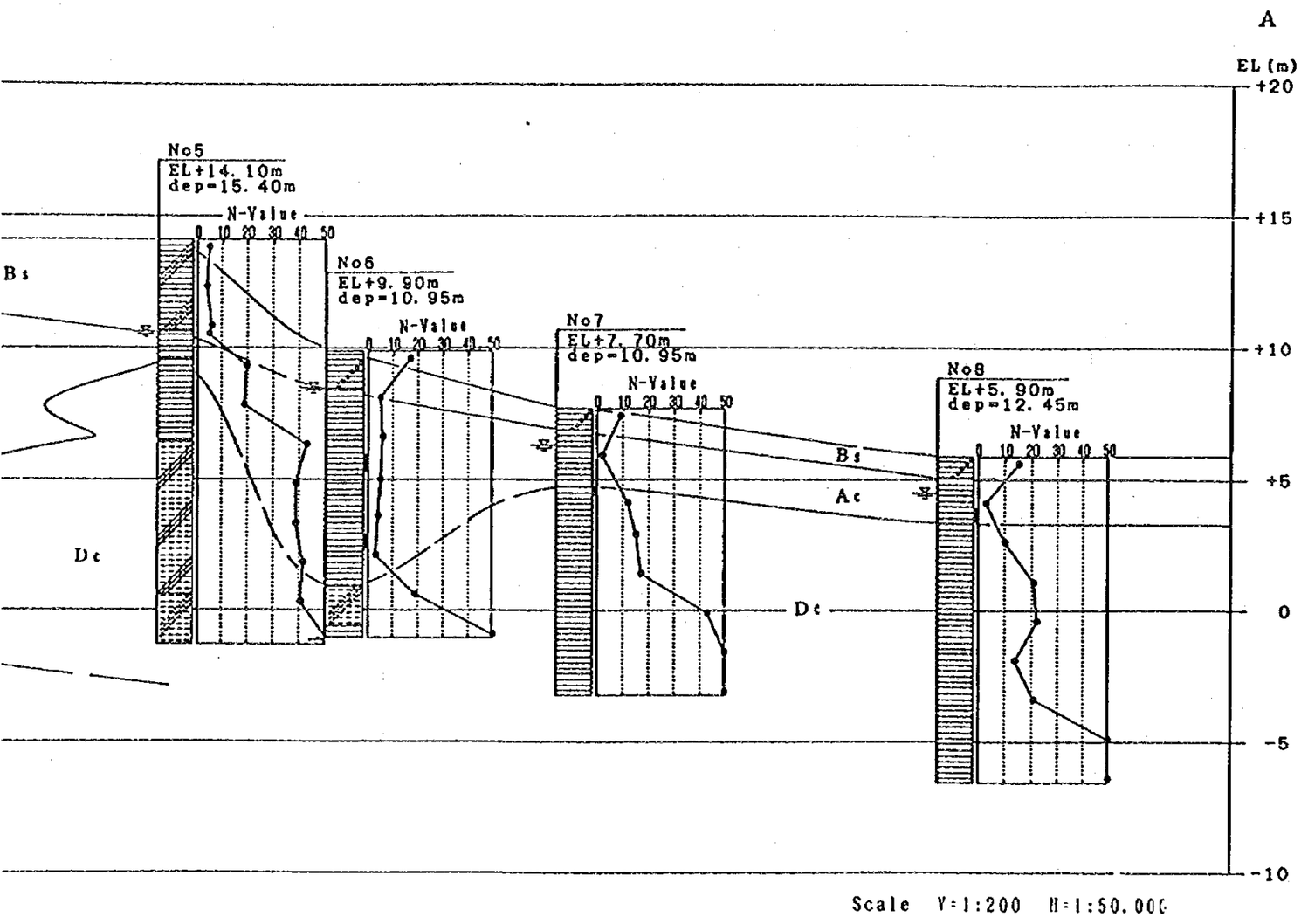
Fig. C.4.1 Location of Borehols and Borrow Pits of the Study Area

A

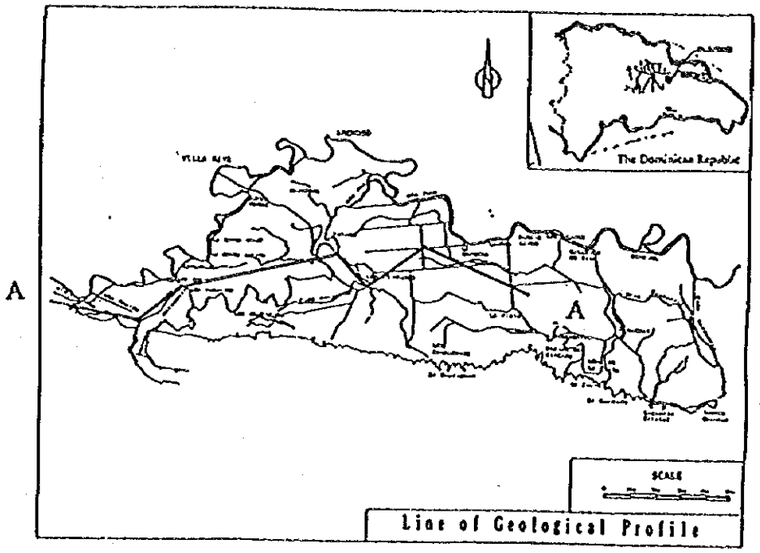


Scale V=1 200 H=1:50,000

Fig. C.5.1 Geological Profile A-A (1)



Scale V=1:200 H=1:50.000



Geological Distribution

Period	Epoch	Legend	Soil type
Quaternary	Alluvium (Holocene)	Bs (Top soil)	Gravely clay Sandy clay Clay
		Ac	Clay
		As	Sand
		Ag	Gravel
	Diluvium (Pleitocene)	Dc	Clay
		Ds	Sand-Clayey sand
		Dg	Gravel
Tertiary	Pliocene	Tc	Clay-Gravely clay

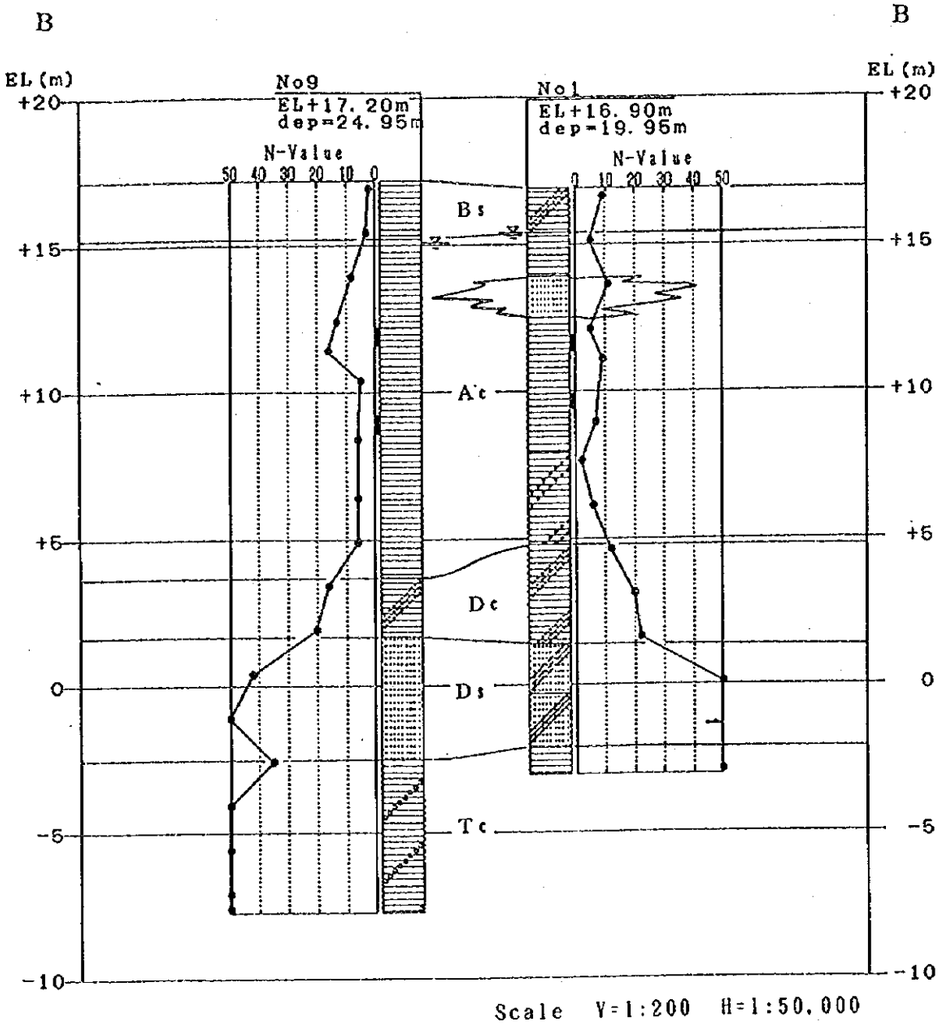
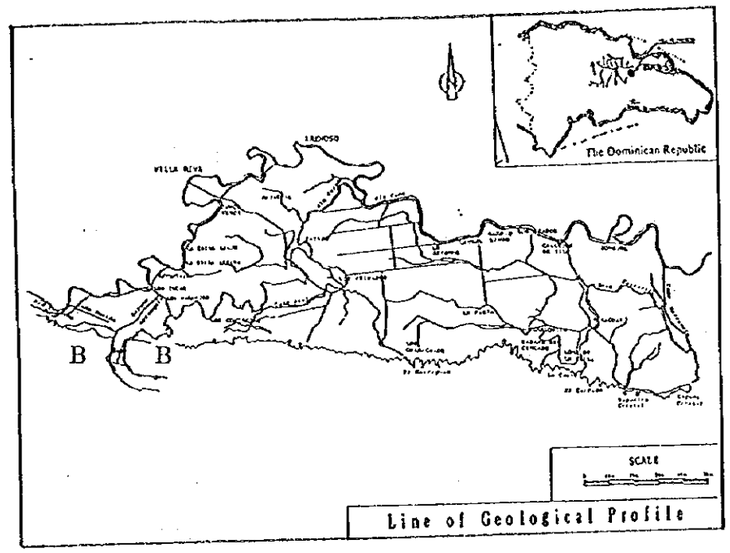


Fig. C.5.1 Geological Profile B-B (2)



Geological Distribution

Period	Epoch	Legend	Soil type
Quaternary	Alluvium (Holocene)	Bs (Top soil)	Gravely clay Sandy clay Clay
		Ac	Clay
		As	Sand
		Ag	Gravel
	Diluvium (Pleitocene)	Dc	Clay
		Ds	Sand·Clayey sand
		Dg	Gravel
Tertiary	Pliocene	Tc	Clay·Gravely clay

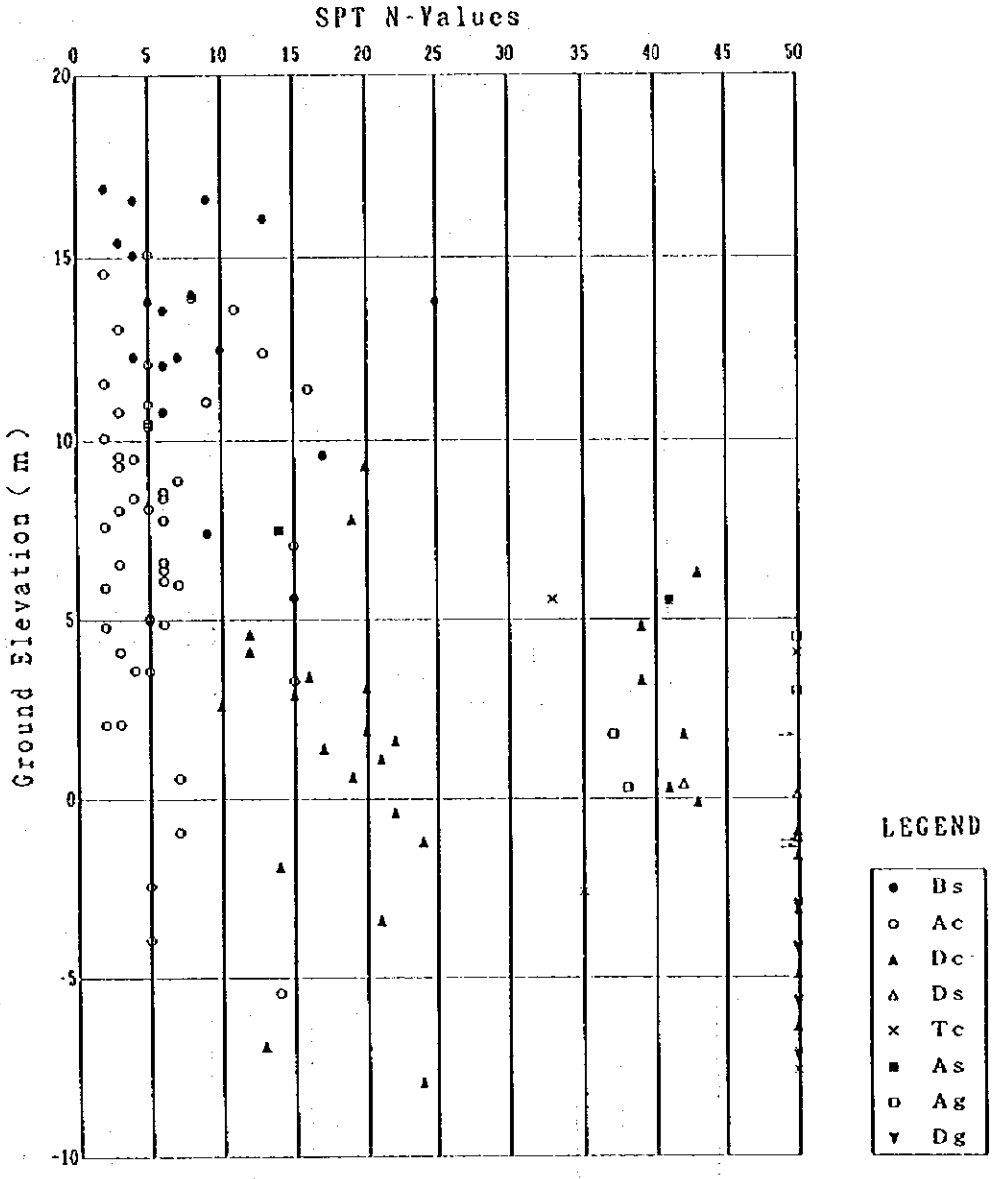
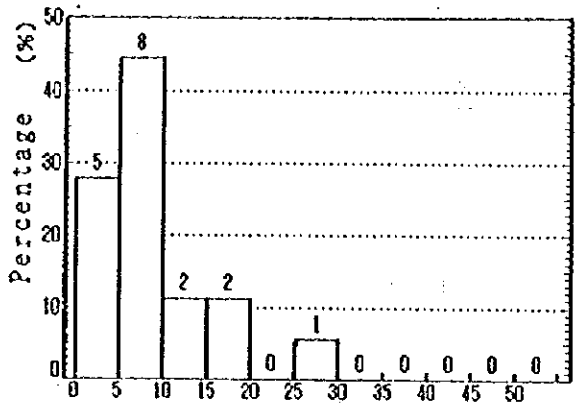


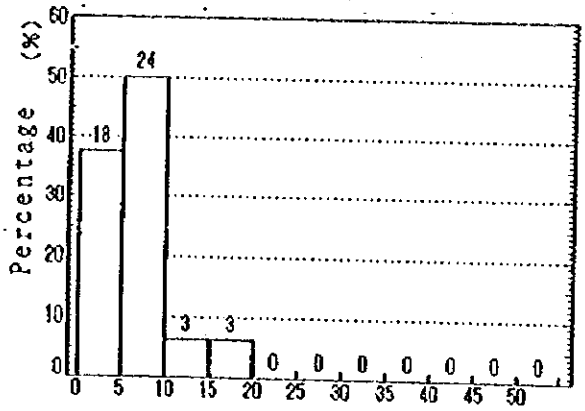
Fig. C.5.2 Relationship of SPT N-Value and Depth



n=18
Ave=8.50
S.DEV=5.659

N-Value (time/30cm)

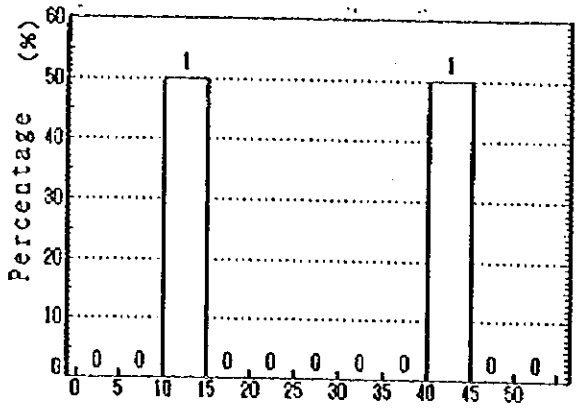
Bs



n=48
Ave=5.75
S.DEV=3.597

N-Value (time/30cm)

Ac

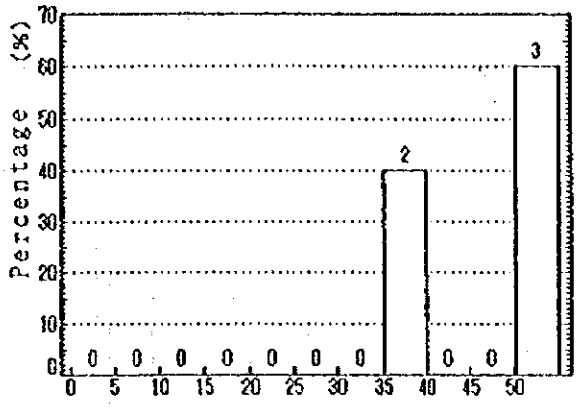


n=2
Ave=27.50
S.DEV=13.50

N-Value (time/30cm)

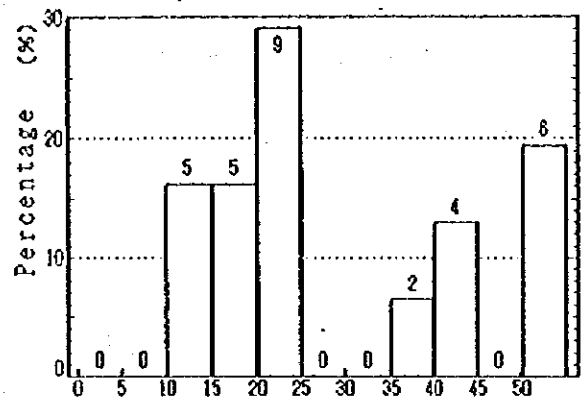
As

Fig. C.5.3 Frequency Chart of Standard Penetration Test (1)



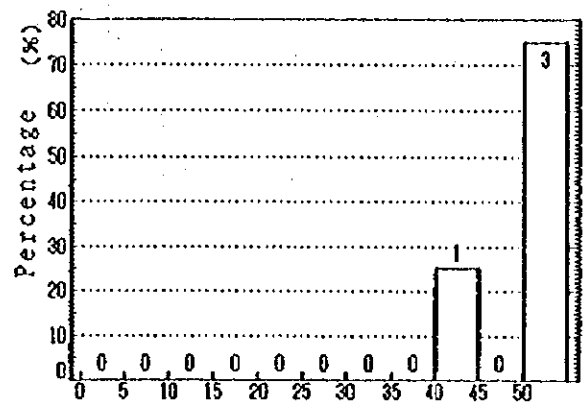
n=5
Ave=65.00
S.DEV=42.867

Ag



n=31
Ave=28.968
S.DEV=14.772

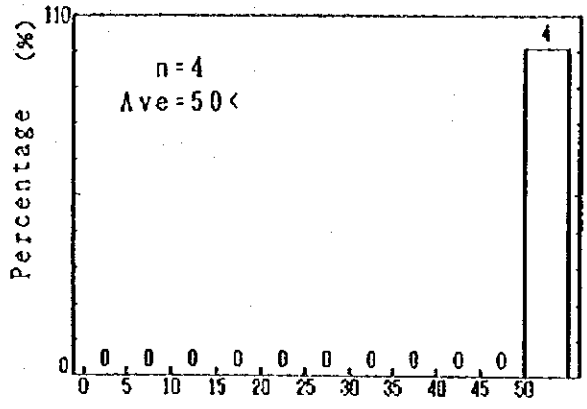
Dc



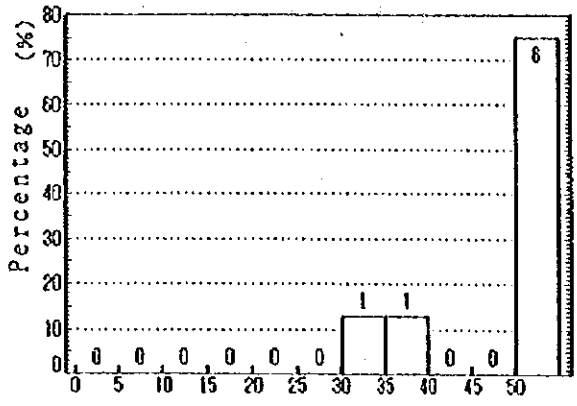
n=4
Ave=50.50
S.DEV=6.384

Ds

Fig. C.5.3 Frequency Chart of Standard Penetration Test (2)



Dg



n=8
Ave=46.00
S.DEV=6.946

Tc

Fig. C.5.3 Frequency Chart of Standard Penetration Test (3)

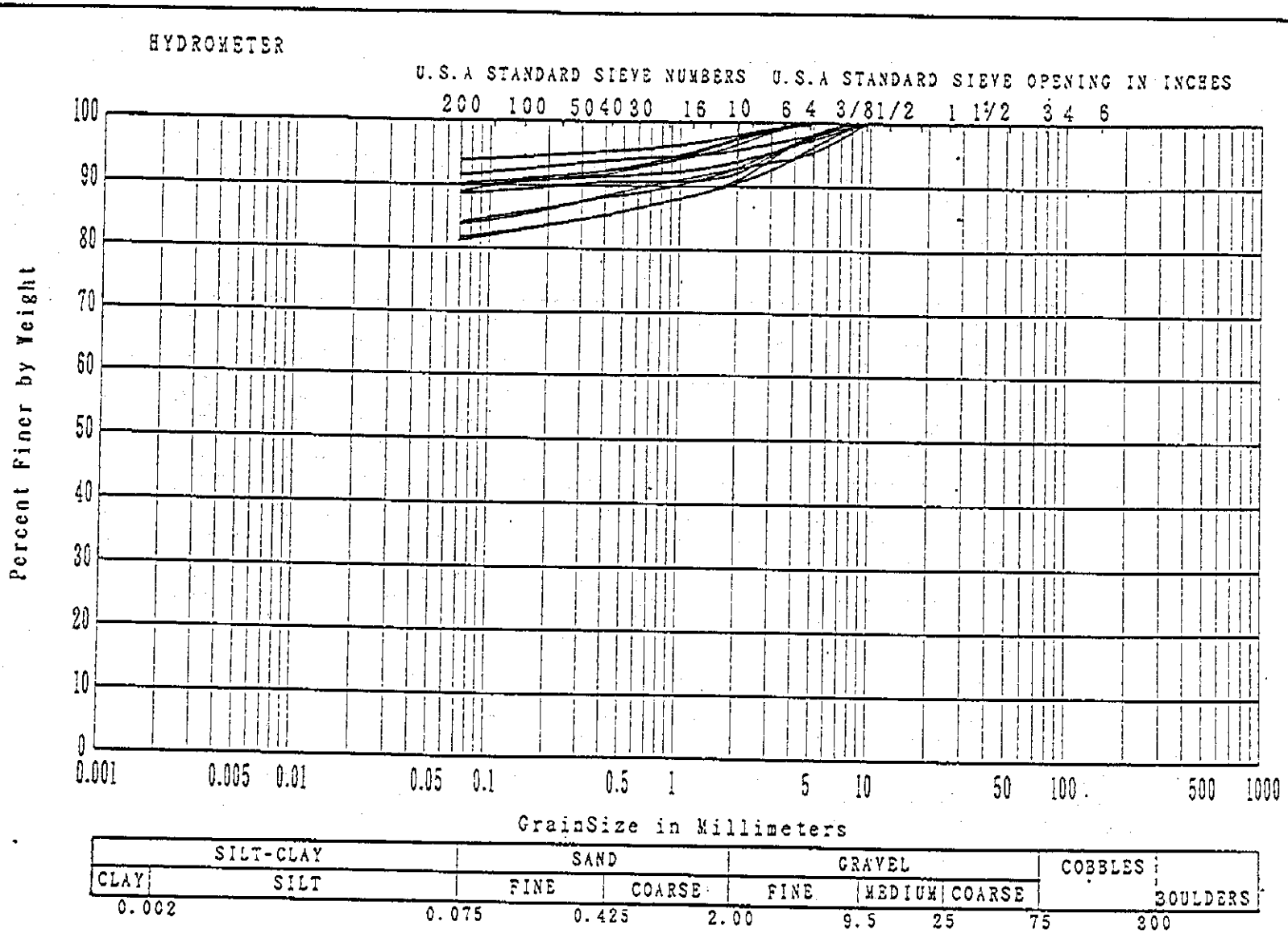
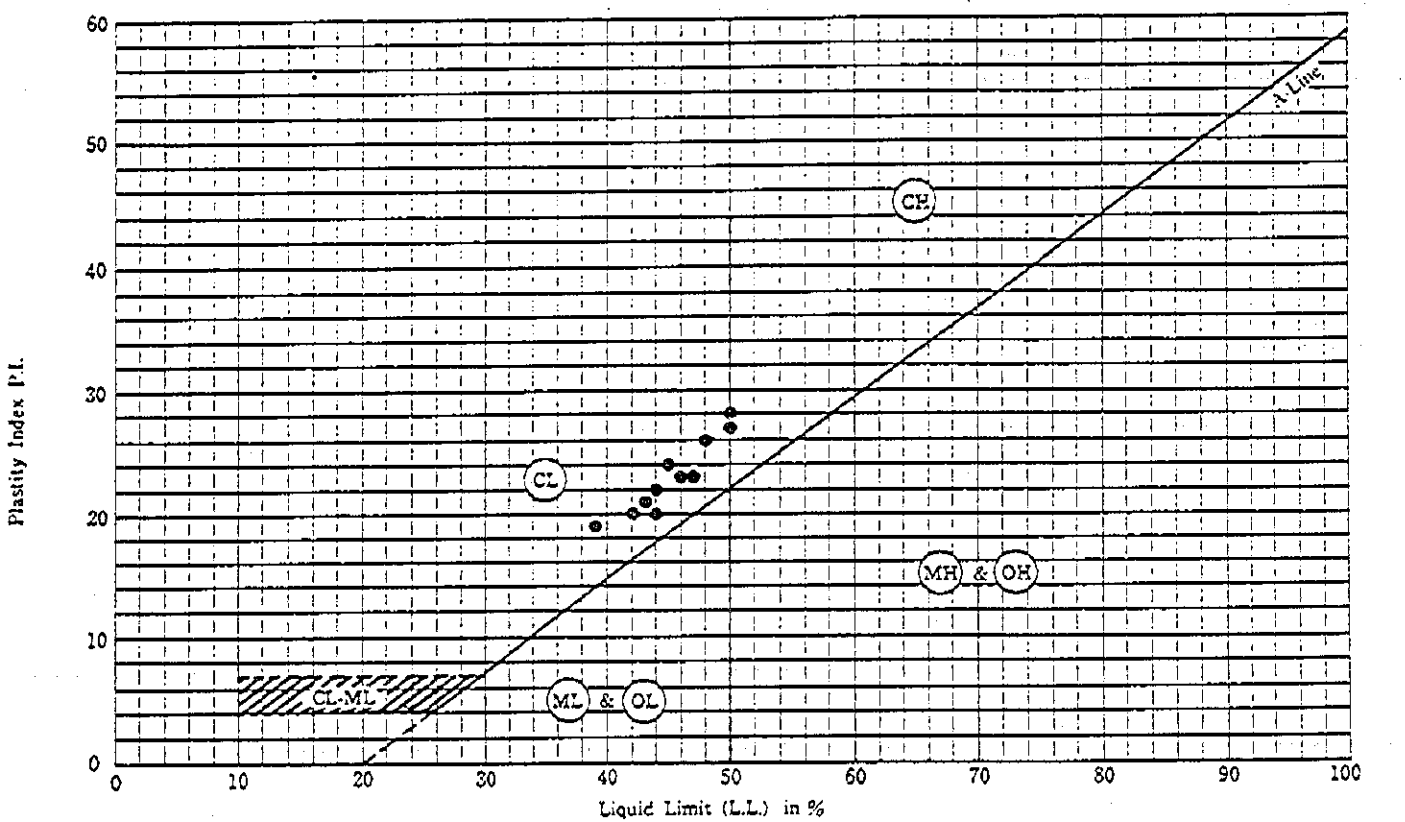


Fig. C.5.4 Gradation Curves of Alluvial Clay (Ac)

CLASSIFICATION BY PLASTICITY CHART

Project: _____ Boring No. _____ Sample No. _____



ML: Inorganic silt with some plasticity, Very fine sand.Rock : flour.Silty or Clayey fine sand and Clayey silt.
CL : Clay containing gravels with low or middle plasticity. : Sandy clay and Silty clay.
OL: Organic silt with low plasticity and Organic silty clay.

MH: Inorganic silt with middle or high plasticity.Micaceous or Diatomaceous fine sandy soil and Silty soil.
CH : Inorganic caly with high plasticity.
OH : Organic clay with middle or high plasticity and Organic silt.

Fig. C.5.5 Plasticity Chart of Alluvial Clay (Ac)

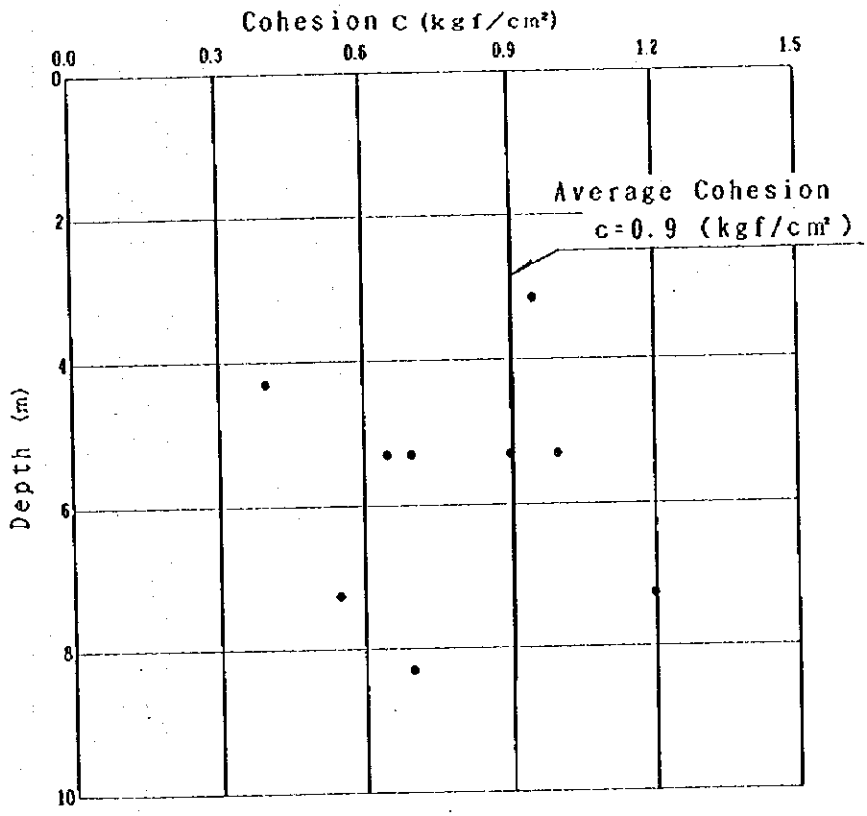


Fig. C.5.6 Relationship of Cohesion of and Depth of Alluvial Clay (Ac)

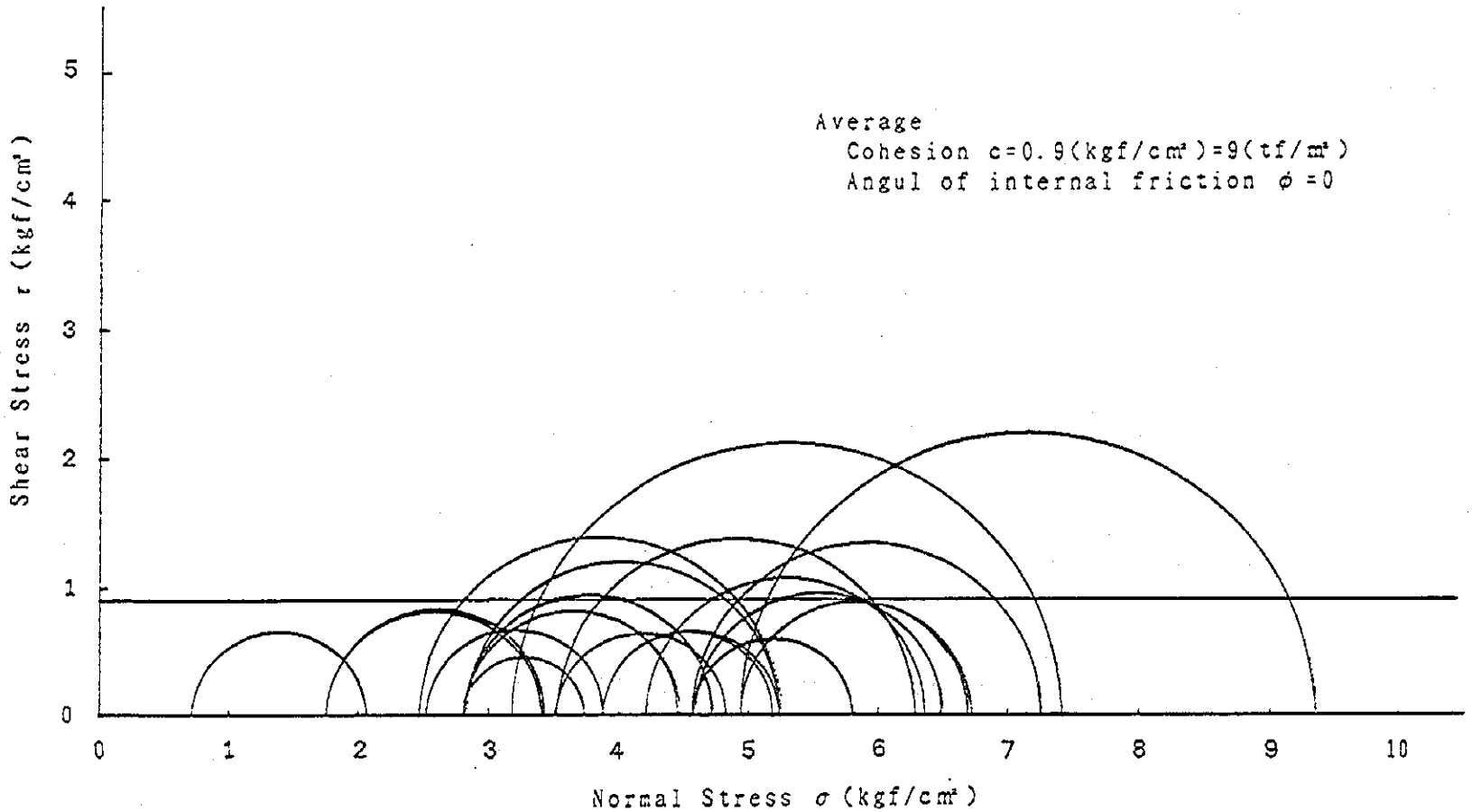


Fig. C.5.7 Mohr's Stress Circle of Alluvial Clay (Ac)

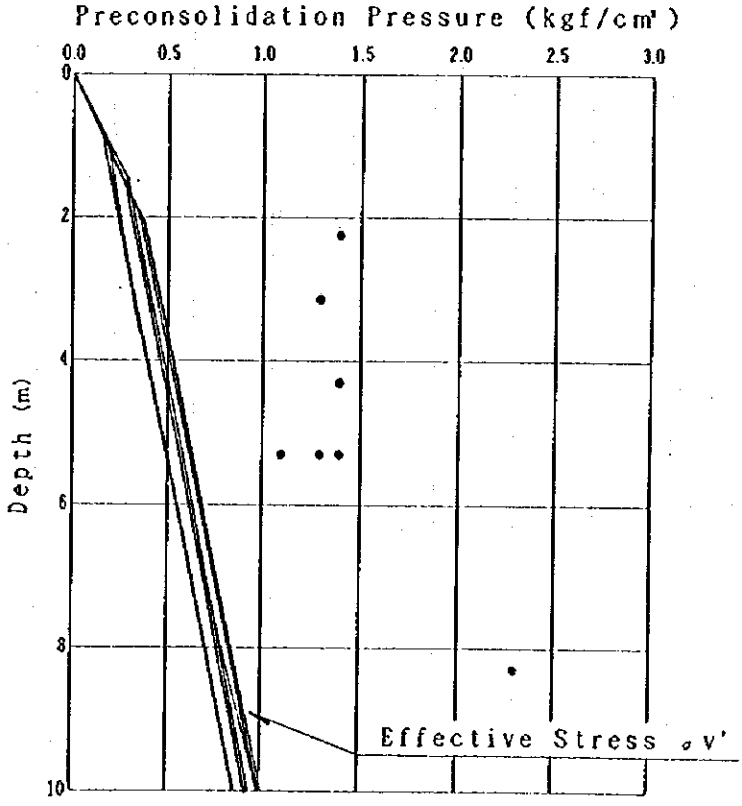


Fig. C.5.8 Relationship of Preconsolidation Pressure and Depth of Alluvial Clay (Ac)

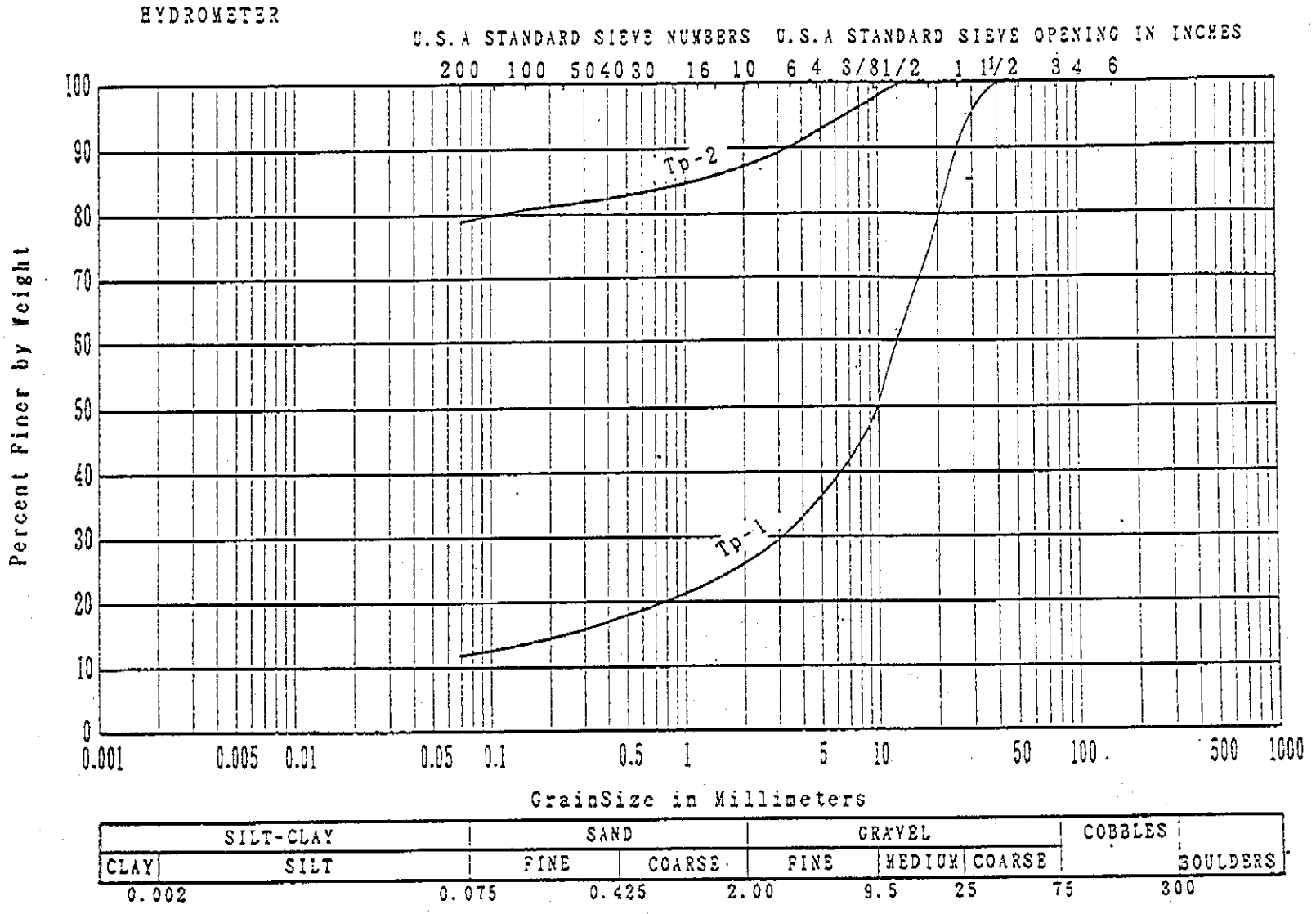
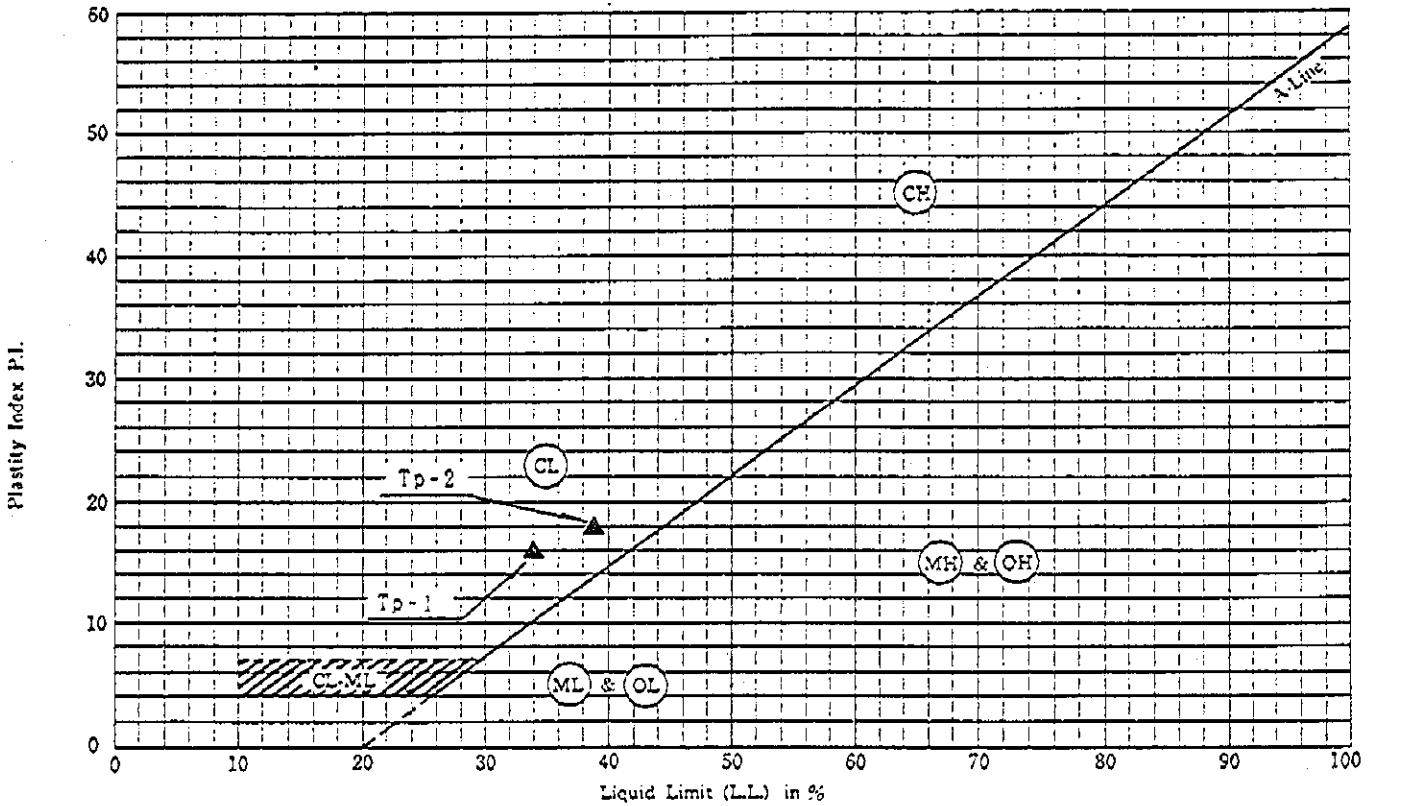


Fig. C.5.9 Gradation Curves of Embankment Material

CLASSIFICATION BY PLASTICITY CHART

Project: _____ Boring No. _____ Sample No. _____



ML: Inorganic silt with some plasticity. Very fine sand, Rock flour, Silty or Clayey fine sand and Clayey silt.
CL: Clay containing gravels with low or middle plasticity. Sandy clay and Silty clay.
OL: Organic silt with low plasticity and Organic silty clay.
MH: Inorganic silt with middle or high plasticity, Micaceous or Diatomaceous fine sandy soil and Silty soil.
CH: Inorganic caly with high plasticity.
OH: Organic clay with middle or high plasticity and Organic silt.

Fig. C.5.10 Plasticity Chart of Embankment Material

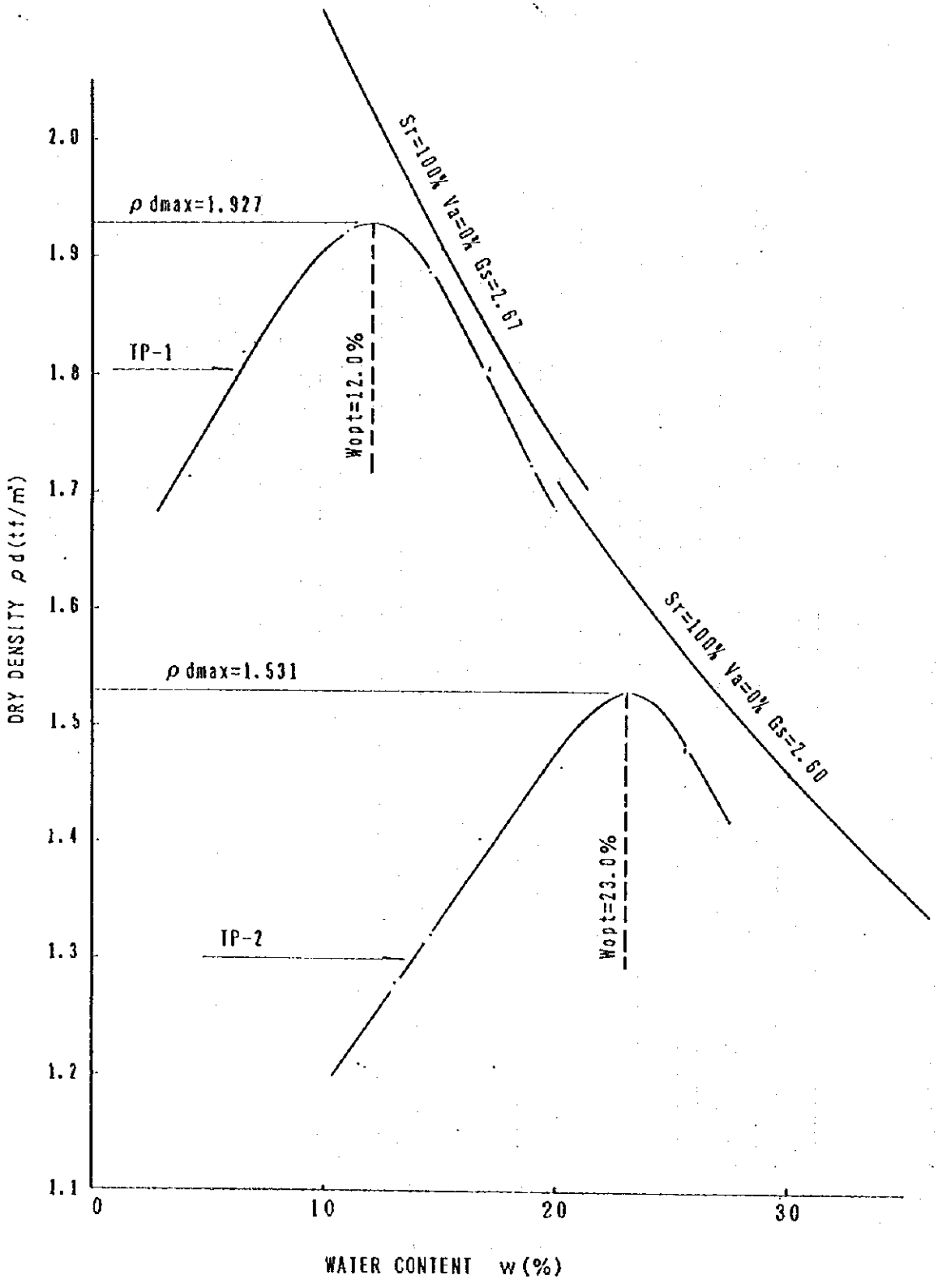
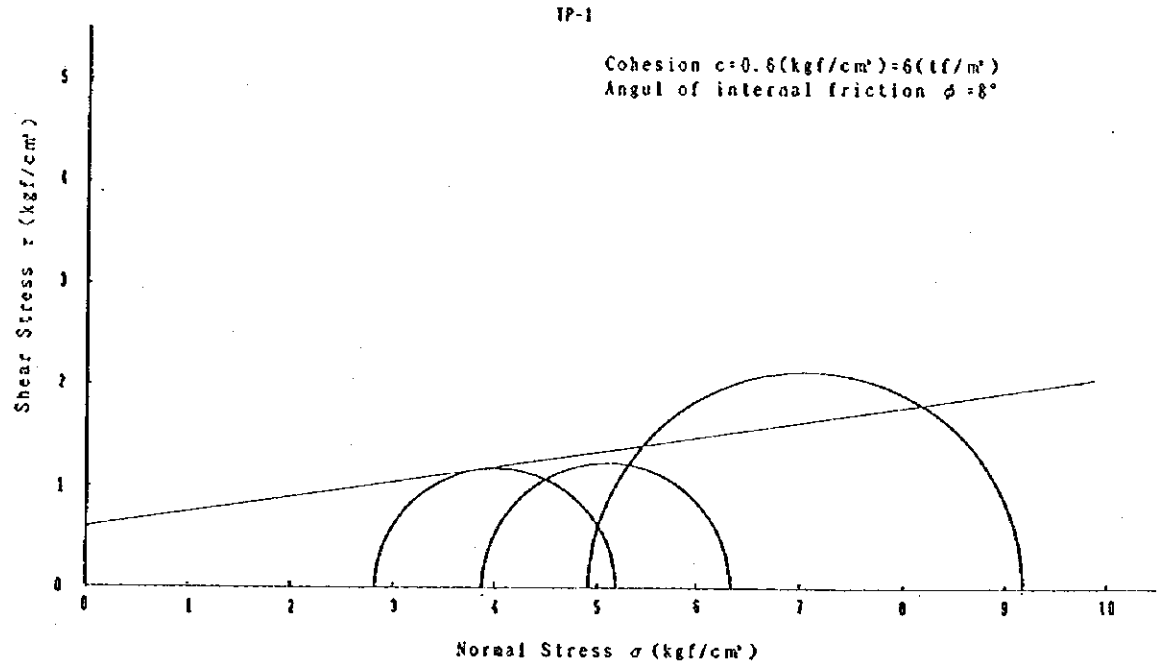


Fig. C.5.11 Moisture-Density Relation of Soil Using Rammer



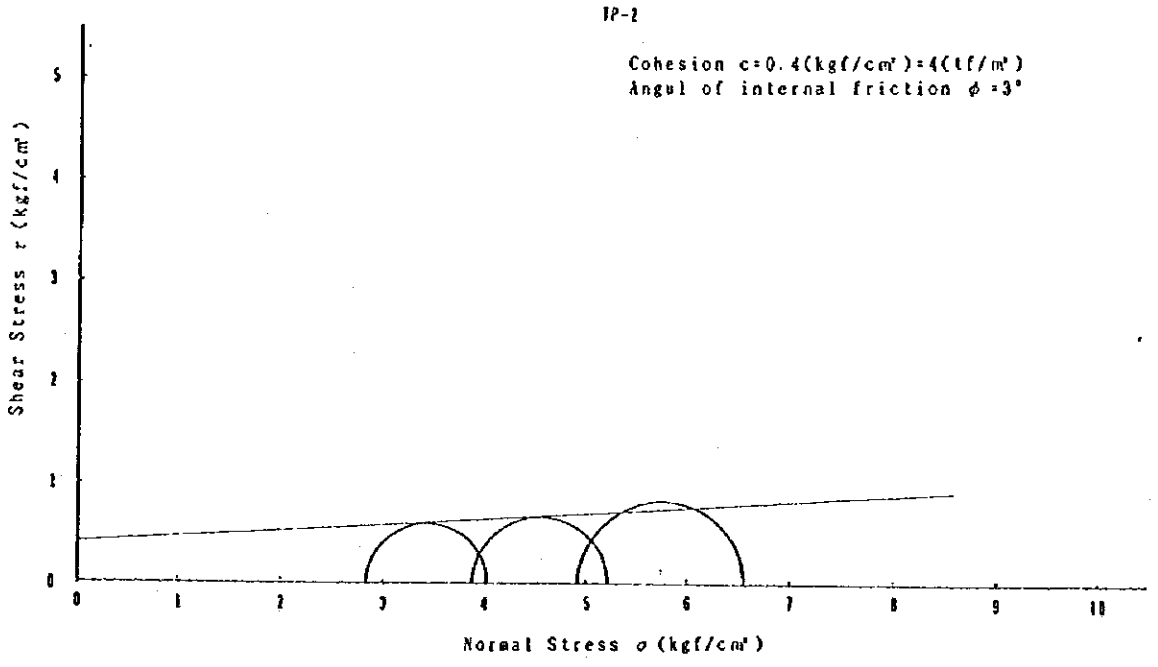


Fig. C.5.12 Mohr's Stress Circle of Embankment Material

ANNEX D : SOILS

ANNEX D : SOIL

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ANNEX D : SOIL

D.1 Brief Review on Soil Features in the Dominican Republic and the Study Area

According to the report entitled as "Reconocimiento y Evaluation de los Recursos Naturales de la Republica Dominicana 1967", which is a product of a systematic survey and evaluation of soils in the country conducted by the Organization of American States (OEA) in the period 1965-66, soils in the Dominican Republic have the following features.

Representative agricultural lands in the Dominican Republic are located in two regions: one is the Cibao region formed by the basins of the Yuna river and the Yaque del Norte river and the other is the Caribbean coastal plain composed of residual soils which are derived from lime stone and calcareous materials of lacustrine sediments.

The soils which are found in the upper stream of the Yuna river are colored in dark brown, composed of granular shaped particles, and are well fertilized. Farmlands in this area are mainly utilized for cultivation of tobacco, maize and banana. In the eastern part of the Yuna river's basin, the compacted clayey soils have formed lands that are suitable for rice cultivation under irrigation. The soils which are distributed in the basin of the Yaque de Norte river are derived from alluvial sediments. These lands are likely to be dried up easily, so irrigation is indispensable for cropping.

The basin of the San Juan river which is a tributary of the Yaque del Sur river lies under arid condition and clayey soils are distributed there. Farmlands are used adequately for rice cultivation under irrigation. In the lowland of the Yaque del Sur river's basin that forms a part of the valley of the Hoya de Enriquillo, the alluvial soils that have deep horizon and are consisted of courser particles are found widely. The greater portion of the plain is utilized for cultivation of sugar cane and banana. The soils existing in the environs of Lake Enriquillo contain a significant amount of salts. Such saline soils are also found also in the lowland at the vicinity of the Yaque del Norte river.

In the Dominican Republic, idle farmlands are found in semi-humid or arid districts without irrigation. On the other hand, in the districts with abundant precipitation for growth of crops and grasses, even the steep woodland have been exploited for agriculture and stock raising. Lands with poor drainage are also used as paddy fields and grazing lands.

In the said report of OEA, soils distribution map to cover whole the country is prepared and the portion correspondent to the Study area is extracted as shown in Fig. D.1.1. In this case, all sorts of soil are divided into four groups (recent alluvial soils, non-calcareous clayey soils, peat and peaty soils, and calcareous earth) on the basis of parent materials from which soils are derived from. The results of the report indicate that soil classification map units coincide with land productive capability units which will be touched upon later.

A detailed soil survey related with the Study area was carried out by FAO from 1974 to 1975, and the results obtained were published in the report: "Los Suelos del Bajo Rio Yuna Mapeo, Clasificacion y Aptitud para los Cultivos", 1976. The content of the report can be summarized as follows:

A lot of different soils formed in the Limon del Yuna area may be classified into five orders of Vertisols, Inceptisols, Mollisols, Alfisols and Histosols, eleven sub-orders, sixteen sub-groups and three associations under soil taxonomy.

In the alluvial plain of the Yuna river, clayey soils including their related ones which are suited for rice cultivation are distributed dominantly on the lowland, while loamy soils which are apt for planting of banana, cacao and coconut palm are concentrated on the terrace. The soils derived from peat or muck lie also in some places.

D.2 Present Soil Survey

D.2.1 Field Survey

Field survey for reconnaissance of soils in the Study area and sampling of soils for laboratory analysis were conducted. Sites of the survey were selected under utilization of references, aerophotos (1:20,000) and topographical maps (1:10,000), and most sites were confirmed by using GPS.

(1) Boring spot test with soil auger

Prior to observation of soil profile, boring spot test was done by using the soil auger. As a result of the test, effective depth, texture, color, contents of the big fragments such as gravel and stone, etc., of soils were known. Furthermore, slope of land surface, biological state, drainage condition, degree of humidity, aspect of erosion and erodibility were observed.

(2) Observation of soil profiles in excavating pits

The observation and description about soil profiles were executed within excavating pits. The procedure of observation was done with the "Soil Survey Manual No.-18 (USDA)" and other supplemental manner of the Dominican Republic. At the rate of average one pit six hundred ha, twenty two pits were dug in total, and on each profile, horizon sequence, effective depth, texture, structure, consistency, plasticity, gravel and stone content, color, hardness, ground water level, root spread, drainage, etc., were observed and recorded. Furthermore, distribution of gravels, rolling stones or bare rocks, landscape, land slope and vegetation were recorded.

(3) Sampling

Sixty one bulky samples of the soils were taken from the representative horizons on the profile of each excavating pit and sent to the "Laboratory" of above mentioned "Seccion" to be analyzed.

D.2.2 Laboratory Analysis of Soil Samples

The soil samples which were sent to the laboratory were analyzed on physical and chemical properties by INDRHI. Items and methods which have been employed are as follows:

(1) Physical properties;

- Particle-size distribution
- Water content at permanent wilting point (Pressure membrane method at 15 bar)
- Real specific gravity (Pycnometer method)
- Field capacity (Pressure membrane - unglazed disk method at 1/3 bar)
- Bulk density
- Saturated water capacity
- Content of particles larger than 2 mm = Gravel content

(2) Chemical properties

- pH and EC of saturated pastes
- Content of soluble cations and anions
  Ca^{+2} and Mg^{+2}: Titration with EDTA
  Na^{+} and K^{+} : Atomic absorption spectroscopy
  CO^{-2} and HCO_3^{-} : Titration with acid
  Cl : Precipitation with $AgNO_3$
  S : Using Spectronic-20, precipitating as barium sulfate
- Exchangeable ions
  Extraction with ammonium acetate solution, formaldehyde method and atomic absorption spectroscopy
- Organic matter content : Walkley and Black's procedure
- $CaCO_3$: Gas analysis
- Trace elements : Atomic absorption spectroscopy
- Phosphorus, nitrogen, boron, and sulfur: Using Spectronic - 20 with a photoelectric tube and an infrared filter.

D.3 Soils Survey Result

Almost two decades has passed since FAO completed their survey, therefore it is suppose that the properties and distribution pattern of the soils in the Study area might have shown some transformations to have been effected by frequent attack of flood and by construction of engineering works for irrigation and drainage during the period.

The purpose of this phase of the Study is to verify whether the above-mentioned transformation appears on the soils or not.

D.3.1 The Creation of New Soil Series

The soil description and analytical data to have been revealed as a result of the Phase I field works are compiled in the Table D.3.1 (1) - (22).

It was confirmed that there no fundamental transformation of soils between those distributed at the time of FAO survey and those existing at present. However, in some places, an additional sedimentation composed of relatively new soil materials such as clay and silt that would have been brought in by flood for many years and the drying tendency of the meadow soils by artificial drainage were observed.

On the basis of such verification, twelve soil series have been created by the Study Team with transferring a part of the former soil series which had been established by the FAO survey team. Lists of newly created soil series and of accordingly corrected former soil series are given in Tables D.3.2 and D.3.3, respectively.

D.3.2 A Short Sketch of Newly Created Soil Series

(1) Los Contreras (LC*)

It is found in the land which is put between the Payabo river and the Guaraguao stream and attacked habitually by floods; the texture of the surface layer is silty loam or silty clay; the boundary between surface soil layer and sub-surface clay one is clear-cut; the depth of the surface layer is variable with places; the dominant clay mineral is a sort of swelling one; considerable amounts of the iron- and manganese-mottles are contained in sub-surface clay layer; the drainage is imperfect; the water table occurs at the top of the clay layer.

(2) La Reforma (LR*)

It is found in the land which is visited customarily by inundation waters from the past and the present flows of the Yuna river; the color is light; the mottles are spotted from the surface soil to the sub-surface one; it is rich in swelling clay minerals; the permeability is low; natural fertility is high; no saline and no alkaline; the representative view is paddy rice field.

(3) La Cueva (Lac*)

It is found in the floodable land which is put between the Yuna river and the Barracote river; the color is dark; it is rich in highly sticky clay materials; the drainage is imperfect.

(4) La Majagua (LM*)

It is occurred in the background of the Yuna river's bank; the effective horizon is deep; the color is dark; a considerable amount of organic matter is contained; the structure in soil horizon develops well; the drainage is good; no saline and no alkaline; the natural fertility is medium to high; the land is suitable for cropping of cacao.

(5) Callejon de Tilo (C.Tilo*)

It is formed as a result of coagulation of the sediment from the Yuna river; the effective horizon is deep; the color is light; organic matter is admixed; dominant clay mineral changes in various kinds; there seems calcium carbonate is contained; the drainage is imperfect; the water table usually lies at the depth of 1.5m from the surface; the drain is required to prevent the soil from the overflow.

(6) Boca de Cevicos (BC*)

It is found in the background of the Yuna river; the depth of the effective horizon is moderate; the color is dark in surface soil and whitish in sub-surface one; the content of organic matter is little; the structure develops moderately; the drainage is good; the land is suitable for cropping of cacao

(7) La Verde (LV*)

It occurs in the floodable land between the Yuna river and the Payabo one; the effective soil layer is deep; the surface soil assumes a pale color; the prismatic structure develops; the drainage is imperfect; appearance of the iron and manganese-mottles increases with depth; alluvial sediments lie under the clay layer.

(8) Guaraguao (G*)

It lies in the part going a little toward east of the center of the Study area; the surface soil layer assumes a grayish blue color; the iron- and manganese mottles exist in the sub soil layer; the gray to yellow colored clay layer lies under the sub soil layer; with drying, the cracks open and the slickensides appear; after drying,the block becomes hard and does not break even in moistened state; owing to the shallow water table, the tendency toward the swamp is evident.

(9) Las 600 Atlas

It is found in the eastern part of the Study area; the iron- and manganese-mottles appear in the sub clay layer.

(10) Los Peinados (LP*)

It occurs in nearly central part of the Study area; because of the excess of humidity, the structure can't be identified; the drainage is poor; the water table is shallow.

(11) Paraguay (PA*)

It is found in the eastern part of the Study area; the effective horizon is deep; the color is light; the drainage is imperfect; the iron- and manganese-mottles lie scattered in the clay layer.

(12) Cristal (Cr*)

It is a sort of organic soil that is found in the southeast part of the Study area.

(note * : Symbol)

D.3.3 Preparation of A New Soil Classification Map

On the basis of the results obtained in the present study, a soil classification map was newly prepared and shown in Fig.D.3.1.

D.3.4 Summary

The soil types of which the distribution has been confirmed by the present soil survey are as follows:

According to a classification system of Soil Taxonomy, a lots of soil units that fall into five orders of Vertisols, Inceptisols, Mollisols, Alfisols, and Histosols, and three associations of Inceptisols/Mollisols/Entisols, Inceptisols/Histosols, and Inceptisols/Vertisols occurs in the Study area.

As in Fig.D.3.1, a range of relatively young soils - Inceptisols occurs dominantly in the background of the Yuna river's bank, a mixed type of soil - Inceptisols/Mollisols/Entisols in the western district along the shore of the Yuna river, the soft soils - Mollisols in the district between the Yuna river and the Payabo one of the western part, a kind of the soils rich in swelling clay minerals - Vertisols in the central district, a group of soils rich in iron and aluminum constituents in the surrounding district of the Vertisols' zone, the peaty soils - Histosols in the southeast part, a class of combined soils - Inceptisols/Histosols in the vicinity of the Histosols' zone, and a group of mixed soils - Inceptisols/Vertisols in the coast of the Baccarote river.

D.4 Land Capability Classification

D.4.1 Previous Studies on Land Capability Classification

Within the context of OEA and FAO's studies mentioned before, land capability classification were also made.

From the land productive classification map that is appended to the OAE's report , a portion relating to the present Study area is shown is drawn as given in Fig.D.4.1. As in the figure, the lands in the Study area are classified into four classes of II, IV, V and VII in the light of the criterion of their productivity for agricultural use. As mentioned previously, the distribution pattern of the land units coincides with it of the soil units.

In the FAO's report, the soil units in the Study area are evaluated into five grades in accordance with the standard that has been advocated by Arens on the land capability classification for irrigation.

D.4.2 Land Capability Classification of the Present Study

The soil series newly created in the present survey were assessed their capability for irrigation use in accordance with Aren's classification system. The results obtained are shown in Tables D.3.2 and D.3.3, respectively.

And, land capability classification map for irrigation is given in Fig.D.4.2.

According to the criterion of the land capability classification for irrigation, the lands graded into five classes occur in the Study area, that is, class 1 having no limitation and being suitable for irrigation to produce the high yield of all sorts of crops that suit to the local climate; class 2 having some limitation of soil, topography and drainage and being suitable for irrigation to produce the high yield of limit sorts of crops; class having severe deficiencies of soil, topography and drainage and being suitable for irrigation to produce moderate yield; class 4 having greater limitation of soil, topography, drainage, economy and flood and being unsuitable for irrigation to produce the most of crops with exception of rice and hygrophytes; class 5 being unsuitable for irrigation though resurvey is required for final decision.

As in Fig.D.4.2, the soils of classes 1 and 2 occur in the districts between the Yuna river and the Payabo river in the west part and on the bank of the Yuna river in the parts from north to northeast, the soils of class 3 in the parts of central south and of east, the soils of class 4 in three parts of northwest, center and southeast, and the soils of class 5 in the coastal of the Baccarote river in the southeast part and in the central east part.

D.5 Consideration on Future Land Use on the Basis of the Soils Survey

The lands lying between the Yuna river and the Payabo river in the east part are suitable for irrigation cultivation of not only rice but also upland crops such as maize, banana, beans, tomato, cabbage, etc. because of their better drainage.

The lands of class 3 which are found in the central south and east parts are deficient in drainage, therefore, they will become arable well for paddy rice if the drainage canals are constructed. In the lands of class 4 which occur in the central part, the high yield of rice may be expected owing to their rich content of swelling clay minerals after completion of drainage canals.

The lands of class 5 are formed with the soils derived from peat and peat materials, so in addition to the construction for irrigation and drainage, the enforcement of some kinds of technology such as land improvement, soil management and cultivation practice is required. On the whole, besides the construction of effective irrigation, it is desirable to implement the measure against inundation and the drainage construction for widely spread clayey low-lands.

ANNEX D : TABLES

Table D.3.1 Soil Description and Analytical Data - 01

Soil Series

Symbol : LC-1
Name : Los Contreras-1

Date	:	Sept. 7, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Almost flat
Physiography	:	Flood plain	Slope	:	2-3%
Location	:	About 0.5 km N.-W. of Los Contreras	Erosion	:	None
Altitude	:	About 14 m above the sea	Erodibility	:	Low
Latitude	:	N. 19° 07' 21"	Gravel content	:	Scarce
Longitude	:	W. 69° 53' 52"	Rock distribution	:	Scarce
Textural appreciation	:	Medium	Natural vegetation	:	
Effective depth	:	90 cm+	Present land use	:	Paddy rice field
Limit of effective depth	:		Parent material	:	
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 24 cm

Texture = Silty clay loam (SilCL); Color = Brownish black (10YR 3/2); Content of organic matter = Very low; Mottles = None; Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Consistence = Friable; Slicken side = None; Pores = Much in content, medium in strengh, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Much; Root spread = Abundant in content and fine in shape; Boundary of horizons = Gradual.

Horizon E 24 - 44 cm

Texture = Sandy clay loam (SCL); Color = Yellowish brown (10YR 5/6); Mottles = Concretion of iron and manganese; Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Consistence = Sticky and plastic; Slicken side = None; Pores = Much in content, medium in strength, and fine in size; Features of biological origin = Small; Root spread = Much in content and fine in shape; Boundary of horizons = Clare.

Horizon B 44 - 90+cm

Texture = Clay (C); Color = Various; Mottles = Mottles of iron; Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Consistence = Very Sticky and very plastic; Cutans = Cutans of clay; Pores = Small in content and fine in size; Features of biological origin = Small; Root spread = Small in content and fine in size.

Laboratorial Analysis

				Horizon A p	Horizon E	Horizon B
Physical properties:						
Particle size distribution	:	Clay	%	47.00	13.60	71.10
	:	Silt	%	31.09	29.00	13.00
	:	Sand	%	21.91	57.40	15.90
Moisture content at permanent wilting point			%	17.38	14.25	18.57
Real specific gravity				-	-	-
Field capacity			%	34.39	21.01	31.15
Apparent specific gravity				-	-	-
Saturated water capacity			%	60	55	110
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				6.20	6.04	5.06
EC (saturation paste)				0.209	0.100	0.100
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	28.09	17.06	18.03
Exchangeable ions	:		meq/100g			
		Ca	"	21.10	6.04	6.00
		Mg	"	4.60	9.00	5.00
		Na	"	1.58	1.58	2.06
		K	"	-	-	-
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 02

Soil Series

Symbol : LC-2
Name : Los Contreras-2

Date	:	Sept. 7, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	3%
Location	:	About 3 km E.-N.-E. of Los Contreras	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 11 m above the sea	Gravel content	:	Scarce
Latitude	:	N. 19° 07' 40"	Rock distribution	:	Scarce
Longitude	:	W. 69° 51' 59"	Natural vegetation	:	
Textural appreciation	:	Medium	Present land use	:	Paddy field after harvest of rice
Effective depth	:	90 cm+			
Limit of effective depth	:		Parent material	:	Ancient alluvium
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 15 cm

Texture = Silty clay loam (SilCL); Color = Brownish black (10YR 3/2); Content of organic matter = Very low; Mottles = None; Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Consistence = Firm; Slicken side = None; Pores = Frequent in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Much in content and fine in shape; Boundary of horizons = Clare.

Horizon B21 15 - 36 cm

Texture = Clay (C); Color = Brown (10YR 4/4); Mottles = Bare; Structure = Sub-angular blocky in shape, thick in size, and moderate in strength; Consistence = Very firm; Very firm; Slicken side = Present; Pores = Frequent in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape; Boundary of horizons = Gradual.

Horizon B22 36 - 90+cm

Texture = Clay (C); Color = Brown (10YR 4/4); Mottles = Present; Structure = Sub-angular blocky in shape, thick in size, and moderate in strength; Consistence = Very firm; Slicken side = Present; Pores = Small in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Very small in content and fine in shape.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	50.40	70.06	48.60
	:	Silt	%	27.00	17.00	29.40
	:	Sand	%	22.60	12.94	22.00
Moisture content at permanent wilting point			%	17.93	17.45	19.21
Real specific gravity				-	-	-
Field capacity			%	31.16	31.95	33.16
Apparent specific gravity				-	-	-
Saturated water capacity			%	94	110	140
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				6.02	4.45	6.00
EC (saturation paste)				0.204	0.220	0.500
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	57.00	30.00	29.00
Exchangeable ions	:		meq/100g			
		Ca	"	34.06	24.00	24.00
		Mg	"	14.00	9.20	4.00
		Na	"	1.10	1.10	0.55
		K	"	0.08	0.02	0.06
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 03

Soil Series

Symbol : LR-1
Name : La Reforma-1

Date	:	Sept. 7, 1994	Natural drainage	:	Poor
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	1%
Location	:	About 3.5 km W.-S.-W. of La Reforma	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 11 m above the sea	Gravel content	:	Scarce
Latitude	:	N. 19° 08' 33"	Rock distribution	:	Scarce
Longitude	:	W. 69° 50' 35 "	Natural vegetation	:	
Textural appreciation	:	Medium to heavy	Present land use	:	Paddy field after harvest of rice
Effective depth	:	90 cm+			
Limit of effective depth	:		Parent material	:	Ancient alluvium
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 20 cm

Texture = Silty clay loam (SilCL); Color = Various; Content of organic matter = Very low; Mottles = Much mottles of iron; Structure = Very muddy owing to be highly moistened; Consistence = Sticky and plastic; Slicken side = None; Pores = Frequent in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Much in content and fine in shape; Boundary of horizons = Clare.

Horizon B21 20 - 40 cm

Texture = Clay (C); Color = Yellowish gray (2.5Y 4/1); Mottles = Gley; Structure = Very muddy owing to be highly moistened; Consistence = Very sticky and very plastic; Slicken side = Present; Pores = Small in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Frequent in content and fine in shape; Boundary of horizons = Gradual.

Horizon B22 40 - 90+cm

Texture = Clay (C); Color = Yellowish brown (2.5Y 5/3); Mottles = Gley; Structure = Very muddy owing to be highly moistened; Consistence = Very sticky and very plastic; Slicken side = Present; Pores = Small in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	50.00	-	-
	:	Silt	%	34.45	-	-
	:	Sand	%	15.55	-	-
Moisture content at permanent wilting point			%	19.23	-	-
Real specific gravity				-	-	-
Field capacity			%	53.19	-	-
Apparent specific gravity				-	-	-
Saturated water capacity			%	110	-	-
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				5.10	-	-
EC (saturation paste)				0.200	-	-
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	28.00	-	-
Exchangeable ions	:		meq/100g			
		Ca	"	23.00	-	-
		Mg	"	4.00	-	-
		Na	"	1.06	-	-
		K	"	0.08	-	-
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 04

Soil Series

Symbol : LR-2
Name : La Reforma-2

Date	:	Sept. 7, 1994	Natural drainage	:	Poor
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	0.5%
Location	:	About 1 km W. of La Reforma	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 11 m above the sea	Gravel content	:	Scarce
Latitude	:	N. 19° 09' 04"	Rock distribution	:	Scarce
Longitude	:	W. 69° 49' 44"	Natural vegetation	:	
Textural appreciation	:	Medium to heavy	Present land use	:	Paddy field after harvest of rice
Effective depth	:	90 cm+			
Limit of effective depth	:		Parent material	:	Ancient alluvium
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 25 cm

Texture = Clay (C); Color = Grayish yellow brown (10YR 4/2); Content of organic matter = Very low; Mottles = Mottles of iron with various colors; Structure = Sub-angular blocky in shape and weak in strength; Consistence = Very sticky and very plastic; Slicken side = None; Pores = Frequent in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Much in content and fine in shape; Boundary of horizons = Clare.

Horizon B21 25 - 60cm

Texture = Silty clay (SilC); Color = Dark olive gray (2.5GY 4/1); Mottles = Gley; Structure = Massive; Consistence = Very sticky and very plastic; Slicken side = None; Pores = Small in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape; Boundary of horizons = Gradual.

Horizon B22 60 - 90+cm

Texture = Silty clay (SilC); Color = Gray (7.5Y 4/1); Mottles = Gley; Structure = Massive; Consistence = Very sticky and very plastic; Slicken side = None; Pores = Small in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Very small.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	70.00	57.08	58.99
	:	Silt	%	15.06	24.58	24.01
	:	Sand	%	14.94	18.34	17.00
Moisture content at permanent wilting point			%	19.46	19.38	17.34
Real specific gravity				-	-	-
Field capacity			%	32.01	33.48	34.14
Apparent specific gravity				-	-	-
Saturated water capacity			%	100	72	44
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				4.06	6.40	7.00
EC (saturation paste)				0.260	0.400	0.400
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	47.18	48.05	25.06
Exchangeable ions	:		meq/100g			
		Ca	"	27.00	32.00	22.00
		Mg	"	15.00	7.00	22.00
		Na	"	1.50	1.02	2.54
		K	"	0.04	0.01	0.01
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 05

Soil Series

Symbol : LR-3
Name : La Reforma-3

Date	:	Sept. 9, 1994	Natural drainage	:	Poor
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	0.5%
Location	:	About 3 km W.-N.-W. of La Reforma.	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 8 m above the sea	Gravel content	:	Scarce
Latitude	:	N. 19° 09' 18"	Rock distribution	:	Scarce
Longitude	:	W. 69° 50' 33 "	Natural vegetation	:	
Textural appreciation	:	Medium to heavy	Present land use	:	Paddy field after harvest of rice
Effective depth	:	90 cm+			
Limit of effective depth	:		Parent material	:	Alluvium
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 9 cm

Texture = Silty loam (SilL); Color = Grayish yellow brown (10YR 4/2); Content of organic matter = Very low; Mottles = Mottles of iron; Structure = Sub-angular blocky, medium in size, and moderate in strength; Consistence = Friable; Slicken side=None; Pores = Much in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Much; Root spread = Much in content and fine in shape; Boundary of horizons = Clare.

Horizon B21 9 - 30 cm

Texture = Silty clay (SilC); Color = Dark greenish gray (10GY 4/1); Mottles = Gley; Structure = Massive; Consistence = Very sticky and very plastic; Slicken side = None; Pores = Much in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Frequent in content and fine in shape; Boundary of horizons = Gradual.

Horizon B22 30 - 90+cm

Texture = Silty clay (SilC); Color = Yellowish brown (10YR 4/1); Mottles = Gley; Structure = Massive; Consistence = Very sticky and very plastic; Slicken side = None; Pores = Small in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root Spread = Small in content and fine in shape.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	59.60	67.00	73.00
	:	Silt	%	22.40	14.65	12.08
	:	Sand	%	18.00	18.35	14.92
Moisture content at permanent wilting point			%	19.31	19.01	18.47
Real specific gravity				-	-	-
Field capacity			%	34.58	31.26	34.49
Apparent specific gravity				-	-	-
Saturated water capacity			%	110	90	124
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				5.30	6.00	6.30
EC (saturation paste)				0.000	0.040	0.239
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	51.10	48.09	45.00
Exchangeable ions	:		meq/100g			
		Ca	"	35.00	28.00	32.00
		Mg	"	12.00	7.00	9.60
		Na	"	1.38	1.26	1.22
		K	"	0.000	0.020	0.020
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 06

Soil Series

Symbol : RE
Name : Reventazon

Date	:	Sept. 8, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Plain	Slope	:	0.5%
Location	:	Reventazon	Erosion	:	None
Altitude	:	About 16 m above the sea	Erodibility	:	Low
Latitude	:	N. 19° 08' 06"	Gravel content	:	Scarce
Longitude	:	W. 69° 54' 59 "	Rock distribution	:	Scarce
Textural appreciation	:	Medium	Natural vegetation	:	
Effective depth	:	90 cm+	Present land use	:	Paddy field after harvest of rice
Limit of effective depth	:				
Inundation	:	Frequent	Parent material	:	Alluvium

Description of the profile

Horizon Ap 0 - 27 cm

Texture = Silty clay loam (SilCL); Color = Grayish yellow brown (YR10 4/2); Mottles = A considerable amount of mottle; Structure = Sub-angular blocky in shape, grand in size, and moderate in strength; Consistence = Firm; Slicken side = None; Pores = Much in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Much; Root spread = Abundant in content and fine in shape; Boundary of horizons = Gradual

Horizon B21 27 - 60 cm

Texture = Silty clay loam (SilCL); Color = Grayish yellow brown (10YR 4/2); Mottles = A considerable amount of mottle; Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Consistence = Firm; Slicken side = None; Pores = Frequent in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Frequent in content and fine in shape; Boundary of horizons = Gradual.

Horizon B22 60 - 90+cm

Texture = Silty loam (SilL); Color = Dark brown (10YR 3/3); Mottles = A considerable amount of mottle; Consistence = Firm; Slicken side = None; Pores = Frequent in content, medium in strength, and fine in size; Content of rock and mineral frag-ments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	54.00	42.00	50.40
	:	Silt	%	15.00	30.00	33.09
	:	Sand	%	32.40	19.00	17.50
Moisture content at permanent wilting point			%	15.38	17.97	19.11
Real specific gravity				-	-	-
Field capacity			%	31.71	31.19	33.01
Apparent specific gravity				-	-	-
Saturated water capacity			%	70	46	80
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				5.08	4.50	6.00
EC (saturation paste)				0.250	0.200	0.205
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	52.00	48.00	53.00
Exchangeable ions	:		meq/100g			
		Ca	"	25.04	32.04	32.04
		Mg	"	4.85	2.08	3.50
		Na	"	1.45	1.71	2.10
		K	"	0.11	0.40	0.10
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 07

Soil Series

Symbol : Lac
Name : Lacueva

Date	:	Sept. 5, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Undulate
Physiography	:	Plain	Slope	:	Less than 4%
Location	:	About 0.9 km E. of Lacueva	Erosion	:	None
Altitude	:	About 4 m above the sea	Erodibility	:	Low
Latitude	:		Gravel content	:	Scarce
Longitude	:		Rock distribution	:	Scarce
Textural appreciation	:	Medium	Natural vegetation	:	
Effective depth	:	90 cm+	Present land use	:	Grass land
Limit of effective depth	:		Parent material	:	
Inundation	:	Frequent			

Description of the profile

Horizon Ah 0 - 10 cm

Texture = Clay loam (CL); Color = Brown (10YR 4/4); Content of organic matter = Very low; Structure = Angular blocky in shape and moderate in strength; Consistence = Very sticky and very plastic; Content of rock and mineral fragments = None; Features of biological origin = Evident; Root spread = Abundant; Hardness = Hard; Boundary of horizons = Gradual.

Horizon B21 10 - 45 cm

Texture = Clay loam (CL); Color = Bright yellowish brown (10YR 6/6); Content of organic matter = Very low; Structure = Angular blocky in shape and moderate in strength; Consistence = Very sticky and very plastic; Content of rock and mineral fragments = None; Features of biological origin = Scarece; Root spread = Small; Hardness = Hard; Boundary of horizons = Gradual.

Horizon B22 45 - 90 cm

Texture = Clay loam to clay (CL-C); Color = Bright yellowish brown (10YR 6/8); Content of organic matter = Low; Structure = Angular blocky in shape and moderate in Strength; Consistence = Very sticky and very plastic; Content of rock and mineral fragments = None; Features of biological origin = None; Root spread = None; Hardness = Hard; Boundary of horizons = Gradual.

Laboratorial Analysis

				Horizon Ah	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	64.90	76.80	76.00
	:	Silt	%	19.00	11.00	11.00
	:	Sand	%	16.10	12.20	13.00
Moisture content at permanent wilting point			%	19.64	19.07	19.23
Real specific gravity				-	-	-
Field capacity			%	33.85	34.80	31.10
Apparent specific gravity				-	-	-
Saturated water capacity			%	94	113	132
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				6.00	6.50	6.30
EC (saturation paste)				0.250	0.300	0.200
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	32.00	33.00	32.00
Exchangeable ions	:		meq/100g			
		Ca	"	8.50	16.00	12.00
		Mg	"	0.09	0.05	0.05
		Na	"	2.04	2.00	4.00
		K	"	0.05	0.05	0.05
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 08

Soil Series

Symbol : LM
Name : La Majagua

Date	:	Sept. 8, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	0.5%
Location	:	About 1.1 km N.-E. of La Verde	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 10 m above the sea	Rock distribution	:	Scarce
Latitude	:	N. 19° 10' 03"	Natural vegetation	:	
Textural appreciation	:	Medium	Present land use	:	Paddy field after harvest of rice
Effective depth	:	90 cm+			
Limit of effective depth	:		Parent material	:	Alluvium
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 21 cm

Texture = Silty loam (SilL); Color = Grayish yellow brown (YR10 4/2); Mottles = A considerable amount of mottle; Structure = Very disturbed; Consistence = Sticky and plastic; Slicken side = None; Pores = Small in content, medium in strength, and fine in size; Content of rock and mineral fragments=None; Features of biological origin = Small; Root spread = Abundant in content and fine in shape; Boundary of horizons = Gradual.

Horizon B21 21 - 60 cm

Texture = Silty loam (SilL); Color = Grayish yellow brown (10YR 4/2); Mottles = A considerable amount of mottle; Structure = Sub-angular blocky in shape, grand in size, and moderate in strength; Consistence = Sticky and plastic; Slicken side = None; Pores = Small in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Small in content and fine in shape; Boundary of horizons = Gradual.

Horizon B22 60 - 90+cm

Texture = Silty loam (SilL); Color = Dull yellowish brown (10YR 4/3); Mottles = A considerable amount of mottle; Structure = Sub-angular blocky in shape, medium in size,and weak in strength; Consistence = Sticky and plastic; Slicken side = None; Pores = Small in content, medium in strengrh, and fine in size; Content of rock and mineral fragments = Very small; Root spread = Very small.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	54.60	62.00	62.00
	:	Silt	%	21.04	22.06	27.04
	:	Sand	%	24.36	15.94	10.96
Moisture content at permanent wilting point			%	18.34	18.19	19.83
Real specific gravity				-	-	-
Field capacity			%	31.02	32.10	31.09
Apparent specific gravity				-	-	-
Saturated water capacity			%	109	113	103
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				7.00	7.00	7.00
EC (saturation paste)				0.400	0.550	0.200
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	45.04	49.09	49.09
Exchangeable ions	:		meq/100g			
		Ca	"	32.00	40.00	34.50
		Mg	"	8.00	9.00	11.04
		Na	"	0.40	0.90	0.94
		K	"	0.62	0.03	0.44
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 09

Soil Series

Symbol : C.Tilo - 1
Name : Callejon de Tilo - 1

Date	:	Sept. 6, 1994	Natural drainage	:	Good
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Back plain of the Yuna river	Slope	:	1%
Location	:	About 1.5 km E. of Borojol	Erosion	:	None
Altitude	:	About 5 m above the sea	Erodibility	:	Low
Latitude	:	N.19° 09' 05"	Gravel content	:	Scarce
Longitude	:	W.69° 44' 17"	Rock distribution	:	Scarce
Textural appreciation	:	Medium	Natural vegetation	:	
Effective depth	:	90 cm+	Present land use	:	Grass land
Limit of effective depth	:		Parent material	:	Alluvium
Inundation	:	Frequent			

Description of the profile

Horizon Ah 0 - 30 cm

Texture = Silty clay loam (SilCL); Color = Dark grayish yellow (2.5Y4/2); Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Consisttence = Slightly sticky and weakly plastic; Pores = Much in content, medium in strength, and fine in shape; Content of rock and mineral fragments = None; Features of bio-logical origin = Much; Root spread = Abundant in content and fine in shape; Hardness = Moderate; Boundary of horizons = Clare.

Horizon B21 30 - 60 cm

Texture = Silty clay loam (SilCL); Color = Dark olive brown (2.5Y 3/3); Structure = Sub-angular blocky in shape, medium in size, and weak in strength; Consistence = Slight sticky and weakly plastic; Pores = Moderate in content, medium in strength, and fine in shape; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Small in content and fine in shape; Hardness = Moderate; Boundary of horizons = Gradual.

Horizon B22 60 - 90+cm

Texture = Silty clay loam (SilCL); Color = Brownish black (2.5YR 3/2); Structure = Sub-angular blocky in shape and weak in strength; Consistence = Slightly sticky and weakly plastic; Pores = Moderate in content, medium in strength, and fine in

shape; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape; Hardness = Moderate.

Laboratorial Analysis

				Horizon Ah	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	52.40	32.00	42.40
	:	Silt	%	37.10	40.10	43.94
	:	Sand	%	10.50	27.90	13.66
Moisture content at permanent wilting point			%	18.87	14.58	17.29
Real specific gravity				-	-	-
Field capacity			%	31.30	29.40	30.11
Apparent specific gravity				-	-	-
Saturated water capacity			%	90	40	65
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				7.70	7.70	7.53
EC (saturation paste)				0.333	0.230	0.230
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	52.00	37.00	31.00
Exchangeable ions	:		meq/100g			
		Ca	"	34.04	20.09	24.08
		Mg	"	8.00	12.50	4.00
		Na	"	0.78	0.82	0.31
		K	"	0.08	0.08	0.01
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 10

Soil Series

Symbol : C.Tilo-2
Nam : Callejon de Tilo-2

Date	:	Sept. 6, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Plain	Slope	:	0.5%
Location	:	About 0.9 km S. of El Callejon de Atilo	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 5.6 m above the sea	Gravel content	:	Scarce
Latitude	:	N.19° 08' 39"	Rock distribution	:	Scarce
Longitude	:	W.69° 46' 10"	Natural vegetation	:	
Textural appreciation	:	Medium	Present land use	:	Grass land
Effective depth	:	90 cm+	Parent material	:	Alluvium
Limit of effective depth	:				
Inundation	:	Frequent			

Description of the profile

Horizon Ah 0 - 30 cm

Texture = Silty clay loam (SilCL); Color = Brownish black (10YR 3/2); Mottles = Iron; Structure = Sub-angular blocky in shape, grand in size and moderate in strength; Consistence = Slightly sticky and weakly plastic; Slicken side = None; Pores = Much in content, fine in size, and medium in strength; Content of rock and mineral fragments = None; Features of biological origin = Abundant; Root spread = Much in content and fine in shape; Hardness = Hard; Boundary of horizons = Clare.

Horizon B21 30 - 60 cm

Texture = Silty loam (SilL); Color = Dull yellowish brown (10YR 4/3); Mottles = Iron; Structure = Sub-angular blocky in shape, fine in size, and weak in strength; Consistence = Slightly sticky and weakly plastic; Slicken side = None; Pores = Much in content, fine in size, and medium in strength; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Frequent in content and fine in shape; Hardness = Hard; Boundary of horizon = Gradual.

Horizon B22 60 - 90+cm

Texture = Clay loam (CL); Color = Grayish yellow brown (10YR 4/2); Mottles = None; Structure = Sub-angular blocky in shape and medium in size, and weak in strength; Consistence = Slightly sticky and weakly plastic; Slicken side = None; Pores = Frequent in content, fine in size, and medium in strength;

Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape; Hardness = Hard.

Laboratorial Analysis

				Horizon Ah	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	50.40	54.80	59.51
	:	Silt	%	29.40	29.40	31.00
	:	Sand	%	21.00	15.80	9.49
Moisture content at permanent wilting point			%	18.21	19.40	20.43
Real specific gravity				-	-	-
Field capacity			%	31.14	31.07	31.81
Apparent specific gravity				-	-	-
Saturated water capacity			%	55	82	70
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				7.49	4.40	7.50
EC (saturation paste)				0.380	0.250	0.220
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	43.00	40.00	42.00
Exchangeable ions	:		meq/100g			
		Ca	"	30.09	36.06	38.09
		Mg	"	4.00	4.09	4.00
		Na	"	0.95	0.72	0.73
		K	"	0.03	0.03	0.02
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 11

Soil Series

Symbol : C.Tilo - 3
Name : Callejon de Tilo - 3

Date	:	Sept. 6, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Slope of hill	Slope	:	0.5%
Location	:	About 1.7 km E.-S.-E. of La Reforma	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 5.5 m above the sea	Gravel content	:	Scarce
Latitude	:	N. 19° 08' 50"	Rock distribution	:	Scarce
Longitude	:	W. 69 47' 58"	Natural vegetation	:	
Textural appreciation	:	Medium	Present land use	:	Paddy field after harvest of rice
Effective depth	:	90 cm+			
Limit of effective depth	:		Parent material	:	
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 -30 cm

Texture = Silty loam (SilL); Color = Brownish black (10YR 3/2); Mottles = Iron; Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Consistence = Sticky and plastic; Slicken side = None; Pores = Much in content, medium in size, and moderate in strength; Content of rock and mineral fragments = None; Root spread = Abundant; Hardness = Hard; Boundary of horizons = Clair.

Horizon B21 30 - 60 cm

Texture = Silty Loam (SilL); Color = Grayish yellow brown (10YR 4/2); Mottles = Gley; Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Consistence = Sticky and plastic; Slicken side = None; Pores = Much in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Root spread = Small; Hardness = Hard; Boundary of horizons = Gradual.

Horizon B22 60 - 90+cm

Texture = Silty loam (SilL); Color = Brownish black (10YR 3/2); Mottles = Gley; Structure = Sub-angular blocky in shape, fine in size, and weak in strength; Consistence = Sticky and plastic; Slicken side = None; Pores = Frequent in content and fine in size; Content of rock and mineral fragments = None; Root spread = Very small; Hardness = Hard.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	-	-	-
	:	Silt	%	-	-	-
	:	Sand	%	-	-	-
Moisture content at permanent willing point			%	-	-	-
Real specific gravity				-	-	-
Field capacity			%	-	-	-
Apparent specific gravity				-	-	-
Saturated water capacity			%	-	-	-
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				-	-	-
EC (saturation paste)				-	-	-
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	-	-	-
Exchangeable ions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 12

Soil Series

Symbol : BC
Name : Boca de Cevico

Date	:	Sept. 8, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	0.5%
Location	:	About 2 km S.-W. of Reven Tazon	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 16 m above the sea	Gravel content	:	Scarce
Latitude	:	N. 19° 07' 35"	Rock distribution	:	Scarce
Longitude	:	W. 69° 56' 03"	Natural vegetation	:	
Textural appreciation	:	Medium	Present land use	:	Paddy field after harvest of rice
Effective depth	:	90 cm+	Parent material	:	Alluvium
Limit of effective depth	:				
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 22 cm

Texture = Silty clay loam (SilCL); Color = Grayish yellow brown (10YR 4/2); Content of organic matter = Very low; Mottles = Much mottles of iron; Structure = Sub-angular blocky in shape and moderate in strength; Consistence = Firm; Slicken side = None; Pores = Much in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Much; Root spread = Much in content and fine in shape; Boundary of horizons = Gradual.

Horizon B21 22 - 50 cm

Texture = Silty clay loam (SilCL); Color = Grayish yellow brown (10YR 4/2); Mottles = Mottles of iron in some places; Structure = Sub-angular blocky in shape, medium in size, and weak in strength; Consistence = Firm; Slicken side = None; Pores = Small in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Frequent in content and fine in shape; Boundary of horizons = Gradual.

Horizon B22 50 - 90+cm

Texture = Silty clay loam (SilCL); Color = Dull yellowish brown (10YR 4/3); Mottles = Some mottles of iron; Structure = Sub-angular blocky in shape, medium in size, and weak in strength; Consistence = Firm; Slicken side = None; Pores = Small in content, medium in strength, and fine in size; Content of rock and

mineral fragments = None; Features of biological origin = Very small; Root spread=Small in content and fine in shape.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	54.00	52.06	58.09
	:	Silt	%	31.60	37.00	32.40
	:	Sand	%	14.40	10.94	9.51
Moisture content at permanent wilting point			%	18.60	12.47	17.94
Real specific gravity				-	-	-
Field capacity			%	32.39	32.41	31.14
Apparent specific gravity				-	-	-
Saturated water capacity			%	81	82	76
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				6.20	6.30	6.30
EC (saturation paste)				0.210	0.211	0.201
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	26.02	22.04	37.50
Exchangeable ions	:		meq/100g			
		Ca	"	22.10	24.04	24.06
		Mg	"	4.00	4.00	5.00
		Na	"	1.11	1.67	1.57
		K	"	0.11	0.11	0.52
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 13

Soil Series

Symbol : LV
Name : La Verde

Date	:	Sept. 8, 1994	Natural drainage	:	Poor
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	0.5%
Altitude	:	About 11 m above the sea	Erodibility	:	Low
Latitude	:	N. 19° 09' 17"	Gravel content	:	Scarce
Longitude	:	W. 69° 52' 41 "	Rock distribution	:	Scarce
Textural appreciation	:	Medium	Natural vegetation	:	
Effective depth	:	90 cm+	Present land use	:	Paddy rice field
Limit of effective depth	:		Parent material	:	Alluvium
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 13 cm

Texture = Silty clay loam (SilCL); Color = Grayish yellow brown (10YR 4/2); Content of organic matter = Very low; Mottles=Much mottles of iron; Structure = Sub-angular blocky in shape, medium in size, and weak in strength; Consistence = Sticky and Plastic; Slicken side = Invisible owing to be highly moistened; Content of rock and mineral fragments = None; Features of biological origin = Much; Root spread = Small; Root spread = Much content and fine in shape; Boundary of horizons = Gradual.

Horizon B21 13 - 45 cm

Texture = Silty clay (SilC); Color = Gray (10Y 4/1); Content of organic matter = Very low; Mottles = Gley; Structure = Sub-angular blocky in shape, medium in size, and weak in strength; Consistence = Very sticky and very plastic; Slicken side = Invisible owing to be highly moistened; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Much in content and fine in shape; Boundary of horizons = Clare.

Horizon B22 45 - 90+cm

Texture = Silty clay (SilC); Color = Dark olive gray (2.5GY 4/1); Content of organic matter = Very low; Structure = Sub-angular blocky in shape, medium in size, and weak in strength; Slicken side = Invisible owing to be highly moistened; Content of rock and mineral fragments = None; Features of biological origin = Small in content and fine in shape.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	53.40	54.09	62.70
	:	Silt	%	31.00	31.00	27.00
	:	Sand	%	15.60	14.91	11.30
Moisture content at permanent wilting point			%	11.04	13.03	13.02
Real specific gravity				-	-	-
Field capacity			%	32.49	32.01	32.39
Apparent specific gravity				-	-	-
Saturated water capacity			%	90	80	84
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation paise)				7.30	7.40	7.40
EC (saturation paste)				0.300	0.400	0.200
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100	42.70	42.00	57.00
Exchangeable ions	:		meq/100g			
		Ca	"	26.00	26.00	26.00
		Mg	"	4.00	4.00	4.00
		Na	"	2.70	2.74	1.76
		K	"	0.10	0.05	0.05
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 14

Soil Series

Symbol : G-1
Name : Guaraguao-1

Date	:	Sept. 6, 1994	Natural drainage	:	Poor
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	0.5%
Location	:	About 1.4 km E.-S.-E. of Guaraguao	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 9.6 m above the sea	Gravel content	:	Scarce
Latitude	:	19° 06' 50"	Rock distribution	:	Scarce
Longitude	:	69° 48' 45"	Natural vegetation	:	
Textural appreciation	:	Medium to heavy	Present land use	:	Paddy field after harvest of rice
Effective depth	:	90 cm+			
Limit of effective depth	:		Parent material	:	
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 30 cm

Texture = Loam (L); Color = Brownish black (2.5Y 2/3); Mottles = None; Structure = Sub-angular blocky in shape, fine in size, and weak in strength; Consistence = Very friable; Slicken side = None; Content of rock and mineral fragments = None; Features of biological origin = Evident; Root spread = Abundant in content and fine in shape; Hardness = Hard; Boundary of horizons = Clare.

Horizon B21 30 - 60 cm

Texture=Clay (C); Color = Bright yellowish brown (10YR 6/6); Mottles = Concretion of iron and manganese; Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Consistence = Firm; Slicken side = None; Content of rock and mineral fragment = None; Features of biological origin = Small; Root spread = Abundant in content and fine in shape; Hardness = Hard; Boundary of horizons = Gradual.

Horizon B22 60 - 90+cm

Texture = Clay (C); Color = Light gray (10YR 8/1); Mottles = Concretion of iron and manganese; Structure = Sub-angular blocky in shape, medium in size, and moderate in strength; Slicken side = None; Consistence = Very firm; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Scarce in content and fine in shape; Hardness = Hard.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	48.10	48.10	-
	:	Silt	%	27.90	17.08	-
	:	Sand	%	24.00	34.82	-
Moisture content at permanent wilting point			%	14.04	18.29	-
Real specific gravity				-	-	-
Field capacity			%	51.39	51.61	-
Apparent specific gravity				-	-	-
Saturated water capacity			%	76	72	-
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				7.00	4.10	-
EC (saturation paste)				0.100	0.100	-
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	34.00	20.00	-
Exchangeable ions	:		meq/100g			
		Ca	"	3.04	4.06	-
		Mg	"	3.04	3.06	-
		Na	"	1.20	1.50	-
		K	"	4.08	4.05	-
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 15

Soil Series

Symbol : G-2
Name : Guaraguao-2

Date	:	Sept. 6, 1994	Natural drainage	:	Poor
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	0.5%
Location	:	About 1.8 km N.-N.-E. of Baraquito	Erosion	:	None
Altitude	:	About 10 m above the sea	Erodibility	:	Low
Latitude	:	N. 19° 07' 50"	Gravel content	:	Scarce
Longitude	:	W.69° 48' 59"	Rock distribution	:	Scarce
Textural appreciation	:	Medium to heavy	Natural vegetation	:	
Effective depth	:	90 cm+	Present land use	:	Paddy rice field
Limit of effective depth	:		Parent material	:	
Inundation	:	Frequent			

Description of the profile

Horizon Ap 0 - 10 cm

Texture = Silty loam (SilL); Color = Black (10YR 1.7/1); Content of organic matter = Abundant; Mottles = None; Structure = Non structure; Consistence = Very friable; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Much in content and fine in shape; Boundary of horizons = Clare.

Horizon E 10 - 30 cm

Texture = Sandy loam (SL); Color = Light gray (10YR 7/1); Content of organic matter = Very low; Mottles = None; Structure = Non structure; Consistence = Very friable; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Frequent in content and fine in shape; Boundary of horizons = Clare.

Horizon B21 30 - 60 cm

Texture = Clay (C); Color = Light gray (10YR 8/1); Content of organic metter = Very low; Mottles = Abundant; Structure = Non structure; Consistence = Sticky and plastic; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape; Boundary of horizons = Gradual.

Horizon B22 60 - 90+cm

Texture = Clay (C); Color = Light gray (10YR 8/1); Content of organic matter = Very low; Mottles = Abundant; Structure = Non structure; Consistence = Sticky and plastic; Content of rock and

mineral fragments = None; Features of biological origin = Very small; Root spread = Very small.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	42.00	47.00	24.40
	:	Silt	%	34.07	30.94	65.60
	:	Sand	%	27.00	22.06	10.00
Moisture content at permanent wilting point			%	17.48	16.37	14.87
Real specific gravity				-	-	-
Field capacity			%	31.21	23.44	31.67
Apparent specific gravity				-	-	-
Saturated water capacity			%	70	40	10
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				7.50	7.00	5.50
EC (saturation paste)				0.500	0.000	0.000
Soluble cations and inions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	25.00	21.00	24.00
Exchangeable anions	:		meq/100g			
		Ca	"	16.04	9.09	15.08
		Mg	"	4.00	1.20	5.00
		Na	"	2.00	1.05	1.54
		K	"	4.05	4.15	4.05
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 16

Soil Series

Symbol : G-3
Name : Guaraguao-3

Date	:	Sept. 6, 1994	Natural drainage	:	Poor
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	0.5%
Location	:	About 2.6 km N.-N.-E. of Guaraguao	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 10.5 m above the sea	Gravel content	:	Scarce
Latitude	:	N. 19° 08' 06"	Rock distribution	:	Scarce
Longitude	:	W.69° 48' 54"	Natural vegetation	:	
Textural appreciation	:	Medium	Present land use	:	Paddy field after harvest of rice
Effective depth	:	90 cm+			
Limit of effective depth	:		Parent material	:	
Inundation	:	Frequent			

Description of the profile

Horizon Ah1 0 - 20 cm

Texture = Silty loam (SilL); Color = Black (10YR 1.7/1); Origin of organic matter = Peat materials; Mottles = Concretion of iron; Structure = Non structure; Consistence = Friable; Slicken side = None; Pores = Much in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biologica origin = Small: Root spread = Abundant in content and fine in shape; Boundary of horizons = Gradual.

Horizon Ah2 20 - 60 cm

Texture = Silty clay loam (SilCL); Color = Black (YR 1.7/1); Origin of organic matter = Peat materials; Mottles = Concretion of iron; Structure = Non structure; Consistence = Sticky and plastic; Slicken side = None; Pores = Much in content and fine in size; Conent of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Much in content and fine in shape; Boundary of horizons = Clare.

Horizon B 60 - 90+cm

Texture = Clay (C); Color = Dull yellow orange (2.5Y 6/3); Mottles = Gley; Structure = Non structure; Consistence = Very sticky and very plastic; Slicken side = None; Pores = Small in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape.

Laboratorial Analysis

				Horizon Ah 1	Horizon Ah 2	Horizon B
Physical properties:						
Particle size distribution	:	Clay	%	64.80	63.92	67.99
	:	Silt	%	18.06	17.00	17.00
	:	Sand	%	17.09	19.08	15.01
Moisture content at permanent wilting point			%	19.34	17.64	20.82
Real specific gravity				-	-	-
Field capacity			%	33.47	38.67	39.70
Apparent specific gravity				-	-	-
Saturated water capacity			%	90	88	149
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				6.70	6.70	6.40
EC (saturation paste)				0.100	0.200	0.340
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	36.00	42.00	53.00
Exchangeable ions	:		meq/100g			
		Ca	"	22.00	17.00	12.00
		Mg	"	2.08	10.06	8.05
		Na	"	1.10	2.10	2.05
		K	"	4.08	4.05	4.18
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 17

Soil Series

Symbol : Las 600 Altas
Name : Las 600 Altas

Date	:	Sept. 5, 1994	Natural drainage	:	Poor
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Plain	Slope	:	Less than 4%
Location	:	About 0.6 km N.-N.-E. of Barraquito	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 6.5 m above the sea	Gravel content	:	Scarce
Latitude	:		Rock distribution	:	Scarce
Longitude	:		Natural vegetation	:	
Textural appreciation	:	Heavy	Present land use	:	Paddy rice field
Effective depth	:	90 cm+	Parent material	:	Alluvium
Limit of effective depth	:				
Inundation	:	Frequent			

Description of the profile

Horizon Ah 0 - 10 cm

Texture = Lomy clay (LC); Color = Dull yellowish brown (10YR 5/3); Content of organic matter = Low; Structure = Sub-angular blocky in shape and slightly strong in strength; Consistence = Slightly sticky and weakly plastic; Pores = Much to medium in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Evident; Root spread = Abundant: Hardness = Moderate; Boundary of horizons = Gradual.

Horizon Ap 10 - 28 cm

Texture = Loamy clay (LC); Color = Light yellow orange (10YR 8/3); Content of organic matter = Scarce; Structure = Sub-angular blocky in shape and strong instrength; Consistence = Slightly sticky and plastic; Pores = Much in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Moderate; Root spread = Medium; Hardness = Moderate; Boundary of horizons = Gradual.

Horizon B2 28 - 90+cm

Texture = Loamy clay (LC); Color = Dull yellow orange (10YR 7/3); Mottles = Red mottles; Structure = Sub-angular blocky in shape and strong in strength; Consistence = Slightly sticky and plastic; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Small; Hardness = Moderate to hard.

Laboratorial Analysis

				Horizon A h	Horizon A p	Horizon B 2
Physical properties:						
Particle size distribution	:	Clay	%	62.40	65.92	68.00
	:	Silt	%	11.00	13.00	17.00
	:	Sand	%	26.60	21.08	15.00
Moisture content at permanent wilting point			%	17.47	17.51	19.17
Real specific gravity				-	-	-
Field capacity			%	30.40	36.16	17.95
Apparent specific gravity				-	-	-
Saturated water capacity			%	59	60	150
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				5.30	5.00	4.00
EC (saturation paste)				0.200	0.290	0.304
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	16.03	16.05	15.08
Exchangeable Ions	:		meq/100g			
		Ca	"	3.80	4.10	4.50
		Mg	"	4.30	5.00	2.40
		Na	"	1.54	1.21	2.31
		K	"	0.08	0.11	0.12
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 18

Soil Series

Symbol : LP-1
Name : Los Peinados-1

Date	:	Sept. 7, 1994	Natural drainage	:	Poor
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	0.5%
Location	:	About 5 km S. of Los Peinados	Erosion	:	None
Altitude	:	About 11 m above the sea	Erodibility	:	Low
Latitude	:	N. 19° 07' 30"	Gravel content	:	Scarce
Longitude	:	W. 69° 51' 05"	Rock distribution	:	Scarce
Textural appreciation	:	Medium to heavy	Natural vegetation	:	
Effective depth	:	90 cm+	Present land use	:	Paddy field after harvest of rice
Limit of effective depth	:				
Inundation	:	Frequent	Parent material	:	Alluvium

Description of the profile

Horizon Ap 0 - 20 cm

Texture = Silty clay loam (SilCL); Color = Grayish yellow brown (10YR 4/2); Content of organic matter = Very low; Mottles = Mottles of iron; Structure = Non structure; Consistence = Sticky and plastic; Slicken side = Invisible; Pores = Frequent in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Much in content and fine in shape; Boundary of horizons = Clare.

Horizon B21 20 - 45 cm

Texture = Silty clay (SilC); Color = Yellowish gray (2.5Y 5/1); Content of organic matter = Very low; Mottles = Gley; Structure = Non structure; Consistence = Very sticky and very plastic; Slicken side = Visible in a whole of the horizon; Pores = Small in content and fine in size; Content of rock and mineral fragments = None; Featuresof biological origin = Very small; Root spread = Frequent in content and fine in shape; Boundary of horizons = Gradual.

Horizon B22 45 - 90+cm

Texture = Silty clay (SilC); Color = Yellowish gray (2.5Y 4/1); Content of organic matter = Very low; Mottles = Gley; Structure = Non structure; Consistence = Very sticky and very plastic; Slicken side = None; Pores = Very small in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	47.09	56.30	84.03
	:	Silt	%	21.40	21.80	9.90
	:	Sand	%	31.51	21.90	6.07
Moisture content at permanent wilting point			%	19.73	19.54	19.11
Real specific gravity				-	-	-
Field capacity			%	32.40	32.10	33.01
Apparent specific gravity				-	-	-
Saturated water capacity			%	116	99	114
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				4.00	4.05	4.50
EC (saturation paste)				0.410	0.410	0.200
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	54.00	54.00	54.00
Exchangeable ions	:		meq/100g			
		Ca	"	9.09	12.08	14.04
		Mg	"	9.05	8.07	6.05
		Na	"	3.20	2.14	2.50
		K	"	1.00	0.09	0.08
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 19

Soil Series

Symbol : LP-2
Name : Los Peinados-2

Date	:	Sept. 7, 1994	Natural drainage	:	
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Flood plain	Slope	:	1%
Location	:	About 1.6 km W. of Los Peinados	Erosion	:	None
Altitude	:	About 11 m above the sea	Erodibility	:	Low
Latitude	:	N. 19° 10' 26"	Gravel content	:	Scarce
Longitude	:	W. 69° 52' 02"	Rock distribution	:	Scarce
Textural appreciation	:	Medium to heavy	Natural vegetation	:	
Effective depth	:	90 cm+	Present land use	:	Paddy field after harvest of rice
Limit of effective depth	:				
Inundation	:	Frequent	Parent material	:	Alluvium of fine particles

Description of the profile

Horizon Ap 0 - 18 cm

Texture = Silty clay loam (SilCL); Color = Various; Content of organic matter = Very low; Mottles = Much mottles of iron; Structure = Very muddy owing to be highly moistened; Consistence = Sticky and plastic; Slicken side = None; Pores = Frequent in content, medium in strength, and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Much in content and fine in shape; Boundary of horizons = Gradual.

Horizon B21 18 - 60 cm

Texture = Silty clay (SilC); Color = Dark grenish gray (7.5GY 4/1); Mottles = Gley; Structure = Very muddy owing tobe highly moistened; Consistence = Very sticky and very plastic; Slicken side = Grand; Pores = Small in content and fine in size; Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Frequent in content and fine in shape; Boundary of horizons = Clare.

Horizon B22 60 - 90+cm

Texture = Silty clay (SilC); Color = Yellowish brown (2.5 Y 5/3); Mottles = Gley; Structure = Very muddy owing to be highly moistened; Consistence = Very sticky and very plastic; Slicken side = None; Pores = Very small; Content of rock and mineral fragments = None; Features of biological origin = Very small; Root spread = Small in content and fine in shape.

Laboratorial Analysis

				Horizon A p	Horizon B 21	Horizon B 22
Physical properties:						
Particle size distribution	:	Clay	%	50.60	59.46	54.60
	:	Silt	%	31.07	27.50	28.34
	:	Sand	%	18.33	13.04	17.06
Moisture content at permanent wilting point			%	17.94	17.87	19.56
Real specific gravity				-	-	-
Field capacity			%	51.13	51.04	52.18
Apparent specific gravity				-	-	-
Saturated water capacity			%	100	76	106
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				7.30	7.10	7.00
EC (saturation paste)				0.250	0.130	0.250
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	44.00	42.00	54.00
Exchangeable ions	:		meq/100g			
		Ca	"	22.00	23.09	24.05
		Mg	"	8.06	7.06	8.69
		Na	"	2.70	2.91	2.76
		K	"	0.05	0.07	0.57
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 20

Soil Series

Symbol : Pa
Name : La Paraguay

Date	:	Sept. 5, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe - Acosta	Topography	:	Flat
Physiography	:	Plain	Slope	:	Less than 4%
Location	:	About 1.4 km N.- E. of La Paraguay	Erosion	:	None
			Erodibility	:	Low
Altitude	:	About 4 m above the sea	Gravel content	:	Scarce
Latitude	:		Rock distribution	:	Scarce
Longitude	:		Natural vegetation	:	
Textural appreciation	:	Medium	Present land use	:	Grass land
Effective depth	:		Parent material	:	
Limit of effective depth	:	60 cm+			
Inundation	:	Frequent			

Description of the profile

Horizon Ah 0 - 15 cm — Texture = Silty loam (SilL); Color = Dark brown (7.5YR 3/3); Origin of organic matter = Peat materials; Structure = Sub-angular blocky to granular in shape and weak ih strength; Consistence = Slightly sticky and weak plastic to plastic; Content of rock and mineral fragments = None; Features of biologica origin = Evident; Root spread = Abundant; Hardness = Slightly hard to hard; Boundary of horizons = Gradual.

Horizon B21 15 - 30 cm — Texture = Silty clay (SilC); Color = Dark brown (7.5YR 3/4); Origin of organic matter = Peat materials; Structure = Sub-angular blocky in shape and strong in strength;Consistence = Sticky and plastic; Content of rock and mineral fragments = None; Features of biological origin = Moderate; Root spread = Moderate; Hardness = Hard:Boundary of horizons = Clare.

Horizon B22 30 - 60+cm — Texture = Clay loam (CL); Color = Reddish brown (5YR 4/6); Structure = Sub-angular blocky in shape and strong in strength; Consistence = Very sticky and very plastic;Content of rock and mineral fragments = None; Features of biological origin = Small; Root spread = Small; Hardness = Hard; Boundary of horizons = Gradual.

Laboratorial Analysis

				Horizon H 1	Horizon H 2	Horizon B 21
Physical properties:						
Particle size distribution	:	Clay	%	28.39	40.09	44.00
	:	Silt	%	37.90	31.09	27.50
	:	Sand	%	33.71	28.82	28.80
Moisture content at permanent wilting point			%	17.23	18.27	17.97
Real specific gravity				-	-	-
Field capacity			%	30.16	31.47	31.19
Apparent specific gravity				-	-	-
Saturated water capacity			%	52	72	64
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation paise)				6.00	6.70	6.70
EC (saturation paste)				0.200	0.200	0.210
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	18.00	22.04	37.50
Exchangeable ions	:		meq/100g			
		Ca	"	22.10	24.06	24.08
		Mg	"	4.00	4.00	6.00
		Na	"	1.20	2.00	1.50
		K	"	0.08	0.08	0.08
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 21

Soil Series

Symbol : Cr-1
Name : Cristal-1

Date	:	Sept. 5, 1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	Plain	Slope	:	Less than 4%
Location	:	About 1k m N.-W. of Cristal	Erosion	:	None
Altitude	:	About 5 m above the sea	Erodibility	:	Low
Latitude	:		Gravel content	:	Scarce
Longitude	:		Rock distribution	:	Scarce
Textural appreciation	:	Medium	Natural vegetation	:	
Effective depth	:	90 cm+	Present land use	:	Grass land
Limit of effective depth	:	Gravelly layer?	Parent material	:	
Inundation	:	Frequent			

Description of the profile

Horizon H1 0 - 20 cm

Texture = Clay loam (CL); Color = Brownish black (7.5YR 3/1); Origin of organic matter = Peat materials; Structure = Sub-angular blocky in shape and moderate in strength; Consistence = Sticky and Plastic; Content of rock and mineral fragments = None; Features of biological origin = Abundant; Root spread = Abundant; Hardness = Somewhat hard; Boundary of horizon = Gradual.

Horizon H2 20 - 47 cm

Texture = Clay (C); Color = Brownish black (7.5YR 3/2); Origin of organic matter = Peat materials; Structure = Sub-angular blocky in shape and moderate in strength; Consistence = Very sticky and very plastic; Content of rock and mineral fragments = None; Features of biological origin = Evident; Root spread = Small; Hardness = Very hard by consolidating firmly; Boundary of horizons = Clare.

Horizon B21 47 - 90+cm

Texture = Clay (C); Color = Bright yellowish brown (10YR 6/6); Structure = Blocky/non structure in shape and weak in strength; Consistence = Very sticky and very plastic; Content of rock and mineral fragments = None; Root spread = None; Hardness = Hard.

Laboratorial Analysis

				Horizon H1	Horizon H2	Horizon B21
Physical properties:						
Particle size distribution	:	Clay	%	62.90	50.09	62.00
	:	Silt	%	19.08	27.08	17.64
	:	Sand	%	18.04	22.83	20.36
Moisture content at permanent wilting point			%	19.49	20.21	19.83
Real specific gravity				-	-	-
Field capacity			%	33.61	33.16	34.15
Apparent specific gravity				-	-	-
Saturated water capacity			%	119	101	114
Content of gravel			%	-	-	-
Chemical properties:						
pH (saturation patse)				7.00	7.30	7.30
EC (saturation paste)				0.400	0.540	0.540
Soluble cations and anions	:		meq/100g			
		Ca	"	-	-	-
		Mg	"	-	-	-
		Na	"	-	-	-
		K	"	-	-	-
		CO3	"	-	-	-
		HCO3	"	-	-	-
		Cl	"	-	-	-
		S	"	-	-	-
Cation exchange capacity	:		meq/100g	37.00	42.00	24.00
Exchangeable ions	:		meq/100g			
		Ca	"	31.00	32.00	11.14
		Mg	"	2.07	4.10	4.09
		Na	"	1.11	1.16	0.58
		K	"	0.05	0.05	0.06
Organic matter			%	-	-	-
Trace elements	:		ppm	-	-	-
Phosphorus			mg/100g	-	-	-
Nitrogen			%	-	-	-
Boron			ppm	-	-	-
Sulfur			mg/100g	-	-	-

Table D.3.1 Soil Description and Analytical Data - 22

Soil Series

Symbol : Cr-2
Name : Cristal-2

Date	:	Sept. 5,1994	Natural drainage	:	Imperfect
Surveyer	:	Watanabe-Acosta	Topography	:	Flat
Physiography	:	PLain	Slope	:	Less than 4%
Location	:	About 1.5 km N.-N.-W. of Cristal	Erosion	:	None
Altitude	:	About 3 m above the sea	Erodibility	:	Low
Latitude	:		Gravel content	:	Scarce
Longitude	:		Rock distribution	:	Scarce
Textural appreciation	:	Medium	Natural vegetation	:	
Effective depth	:	60 cm+	Present land use	:	Grass land
Limit of effective depth	:	Gravelly layer?	Parent material	:	
Inundation	:	Frequent			

Description of the profile

Horizon H1 0 - 33 cm

Texture = Silty loam (SilL); Color = Brownish black (10YR 3/1); Origin of organic matter = Peat materials; Structure = Granular in shape and weak in strength; Consistence = Slightly sticky and weakly plastic; Content of rock and mineral fragments = None; Features of biological origine = Evident; Root spread = Abundant; Hardness = Soft; Boundary of horizons = Clare.

Horizon B21 33 - 60+cm

Texture = Silty clay (SilC); Color = Dull reddish brown (5YR 4/4); Origin of organic matter = Peat materials; Structure = Sub-angular blocky in shape and moderate in strength; Consistence = Very sticky and very plastic; Content of rock and mineral fragments = None; None; Root spread = None; Hardness = Soft; Boundary of horizons = Gradual.

Laboratorial Analysis

				Horizon H 1	Horizon B 21
Physical properties:					
Particle size distribution	:	Clay	%	24.00	44.00
	:	Silt	%	18.92	32.40
	:	Sand	%	57.08	23.60
Moisture content at permanent wilting point			%	16.70	18.98
Real specific gravity				-	-
Field capacity			%	22.46	32.88
Apparent specific gravity				-	-
Saturated water capacity			%	110	90
Content of gravel			%	-	-
Chemical properties:					
pH (saturation patse)				7.20	7.20
EC (saturation paste)				1.000	0.980
Soluble cations and anions	:		meq/100g		
		Ca	"	-	-
		Mg	"	-	-
		Na	"	-	-
		K	"	-	-
		CO3	"	-	-
		HCO3	"	-	-
		Cl	"	-	-
		S	"	-	-
Cation exchange capacity	:		meq/100g	14.00	32.00
Exchangeable ions	:		meq/100g		
		Ca	"	12.00	14.00
		Mg	"	6.02	10.08
		Na	"	6.64	0.47
		K	"	0.45	0.02
Organic matter			%	-	-
Trace elements	:		ppm	-	-
Phosphorus			mg/100g	-	-
Nitrogen			%	-	-
Boron			ppm	-	-
Sulfur			mg/100g	-	-

Table D.3.2 List of Soil Series ----New Series

New series		Former series Symbol	Area (ha)		Soil order1)	Land class for irrigation2)
Symbol	Name		Unit	Sum		
LC-1 LC-2	Los Contreras	EL(4)*** EJ(2)****	80 90	170	Vertisols	3d/4Rsd
LR-1 LR-2 LR-3 RE	La Reforma**	Pa(1)*** Ldy(4)*** Rf-1(4)*** Re(1)***	80 60 85 50	275	Vertisols	4Rsd 4Rsd 4Rsd 3d
Lac	Lacueva	VR(3)***	55	55	Vertisols	4Rsd
LM	La Majagua	Ce(2)***	60	60	Inceptisols	1
[C.Tilo-1] C.Tilo-2 C.Tilo-3	Callejon deTilo	LCo(4) LCo(2)*** AsD****	- 240 155	395	Inceptisols	3d
BC	Boca de Cevicos	JR(1)***	45	45	Mollisols	1
LV(1) LV(2)	La Verde	n.e.* n.e.*	105 15	120	Alfisols	4Rsd
G-1 G-2 G-3	Guaraguao	EL(9)*** Pr(1)**** Pr(1)****	65 190 585	840	Alfisols	3d/4Rsd
Las 600 Altas		EL(10)*** Ldy(2)***	55	55	Alfisols	4Rsd
LP-1 LP-2	Los Peynados	Re(4)*** Ldy(2)***	50 85	135	Vertisols	4Rsd
PA	La Paraguay**	Re(5)***	40	40	Alfisols	3d
Cr-1 Cr-2	Cristal	CSa***	160 75	235	Histisols	5
Total				2425		

Note * : not established in the past survey.
** : different with the former name.
*** : a part.
**** : the whole.

1) by Soil Taxonomy.
2) by Arens' Classification (1976).
[ ] : not created in the present survey.

Table D.3.3 List of Soil Series ----Corrected Former Series

Crrected former series		Area (ha)		Soil order1)	Soil sub-order1)	Land class for irrigation2)
Symbol	Name	Unit	Sum			
EJ(1)	El Junco	150	150	Vertisols	Cromudert	4Rsd
Pa(1) Pa(2) Pa(3)	Payabo	380 50 40	470	Vertisols	Cromudert	4Rsd
Ldy(1) Ldy(2) Ldy(3) Ldy(4)	Limon del Yuna	90 55 65 225	435	Vertisols	Cromudert	4Rsd
VR(1) VR(2) VR(3)	Villa Riva	20 90 250	360	Vertisols	Cromudert	4Rsd
Ce(1) Ce(2) Ce(3)	Cerrejon	120 440 150	710	Inceptisols	Eutropept	1
LCo(1) LC0(2) LCo(3) LCo(4)	Las Cotes	285 60 285 130	760	Inceptisols	Eutropept	2d
LCo-2	Las Cotes, poor drainage fasc	270	270	Inceptisols	Eutropept	2d
Eto	El Tope	60	60	Inceptisols	Sulfaquept	5
As(1) As(2) As(3)	Agua Santa	140 290 25	455	Inteceptisols	Tropacuept	5
Eri	El Rincon	305	305	Mollisols	Argiacuol	4Rsd
LCe(1) LCe(2)	La Ceiba	120 210	330	Mollisols	Hapludol	1
JR(1) JR(2) JR(3)	Janua Rodgiguez	345 245 95	685	Mollisols	Hapludol	1

(continued)

Crrected former series		Area (ha)		Soil order1)	Soil sub-order1)	Land class for irrigation2)
Symbol	Name	Unit	Sum			
LCr-1	Las Carreras	535	535	Mollisols	Hapludol	3d
EL(1)	El Limon	15	1100	Alfisols	Tropacualf	3d
EL(2)		30				3d
EL(3)		65				3d
EL(4)		205				3d
EL(5)		50				3d
EL(6)		50				3d
EL(7)		15				3d
EL(8)		115				3d
EL(9)		180				3d
EL(10)		235				3sd
EL(11)		30				3d
EL(12)		110				3sd
Re(1)	Reforma	485	1000	Alfisols	Tropacualf	3d
Re(2)		10				
Re(3)		5				
Re(4)		440				
Re(5)		60				
Rf-1(1)	Reforma	80	330	Alfisols	Tropacualf	4Rsd
Rf-1(2)		130				
Rf-1(3)		100				
Rf-1(4)		80				
Rf-0	Reforma	205	205	Alfisols	Tropacualf	4Rsd
Pr(2)	Paraguay	190	355	Alfisols	Albacualf	4Rsd
Pr(3)		165				
Ba	Bavari	100	100	Alfisols	Tropudalf	1
LB(1)	La Barca	35	155	Alfisols	Tropudalf	2d
LB(2)		120				
CSa	Cano Sandoval	130	130	Histosols	Tropohemist	5
AsBY(1)*	Bajo Yuna	35	155	Incepti./ Molli./ Enti.	Eutropept/ Hapludol/ Tropofluvent	1
AsBY(2)*		120				

(continued)

Crrected former series		Area (ha)		Soil order1)	Soil sub-order1)	Land class for irrigation2)
Symbol	Name	Unit	Sum			
AsD(1)* AsD(2)*	Duarte	0 360	360	Incepti./ Histo.	Eutropept/ Tropacuept/ Tropohemist	3d
AsEto-AS-LJa*		160	160	Incepti./ Verti.	Sulfacuept/ Tropacuept/ Cromudert	5
Total			9575			

Note *: Soil association.
1) by Soil Taxonomy.
2) by Arens' Classification (1967).

ANNEX D : FIGURES

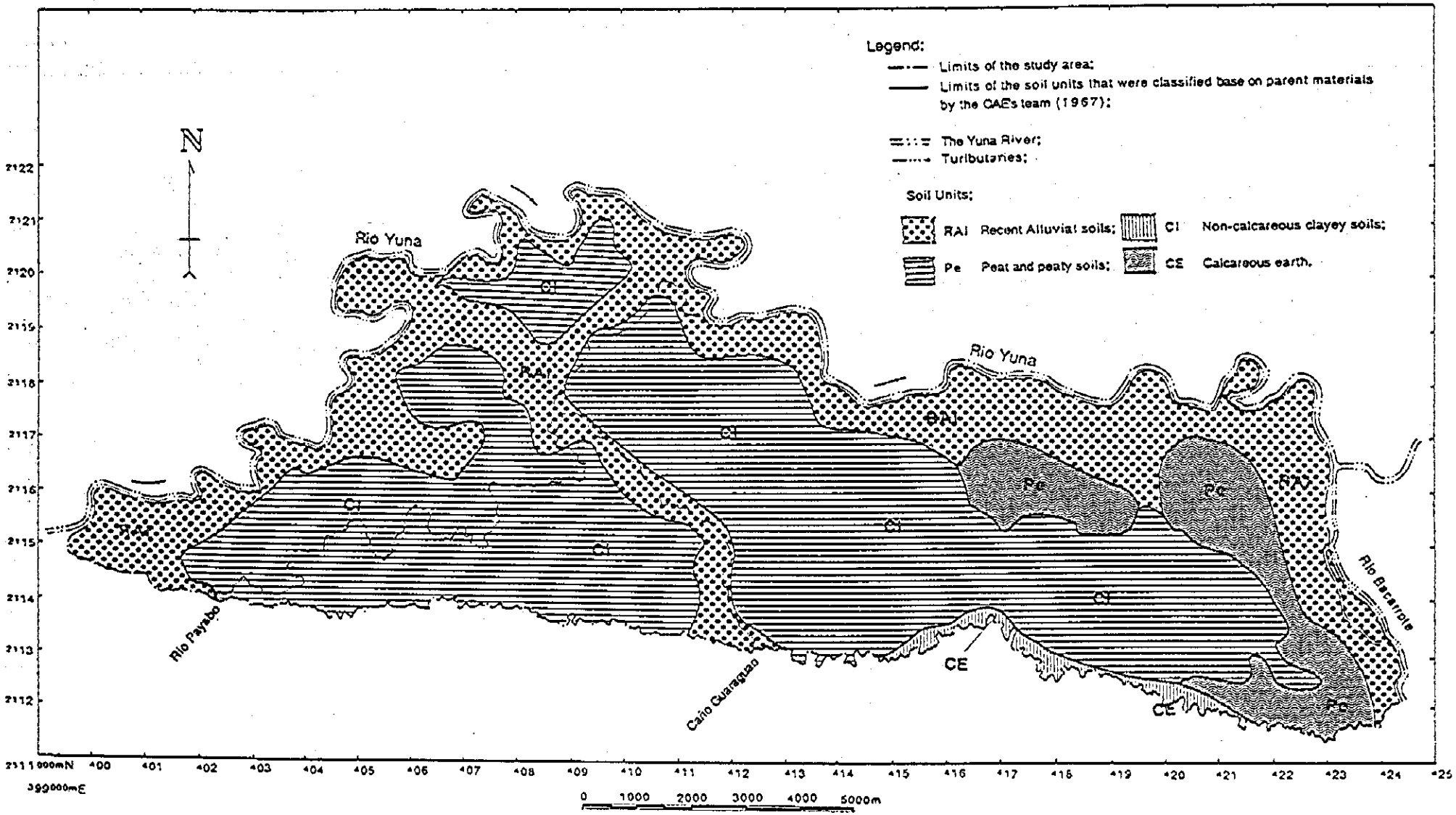

Fig. D.1.1 Soil Classification Map Based on Parent Material

(Quoted from CAE. Reconnocimiento y Evaluacion de los Recursos Naturales de la Republica Dominicana, 1967)

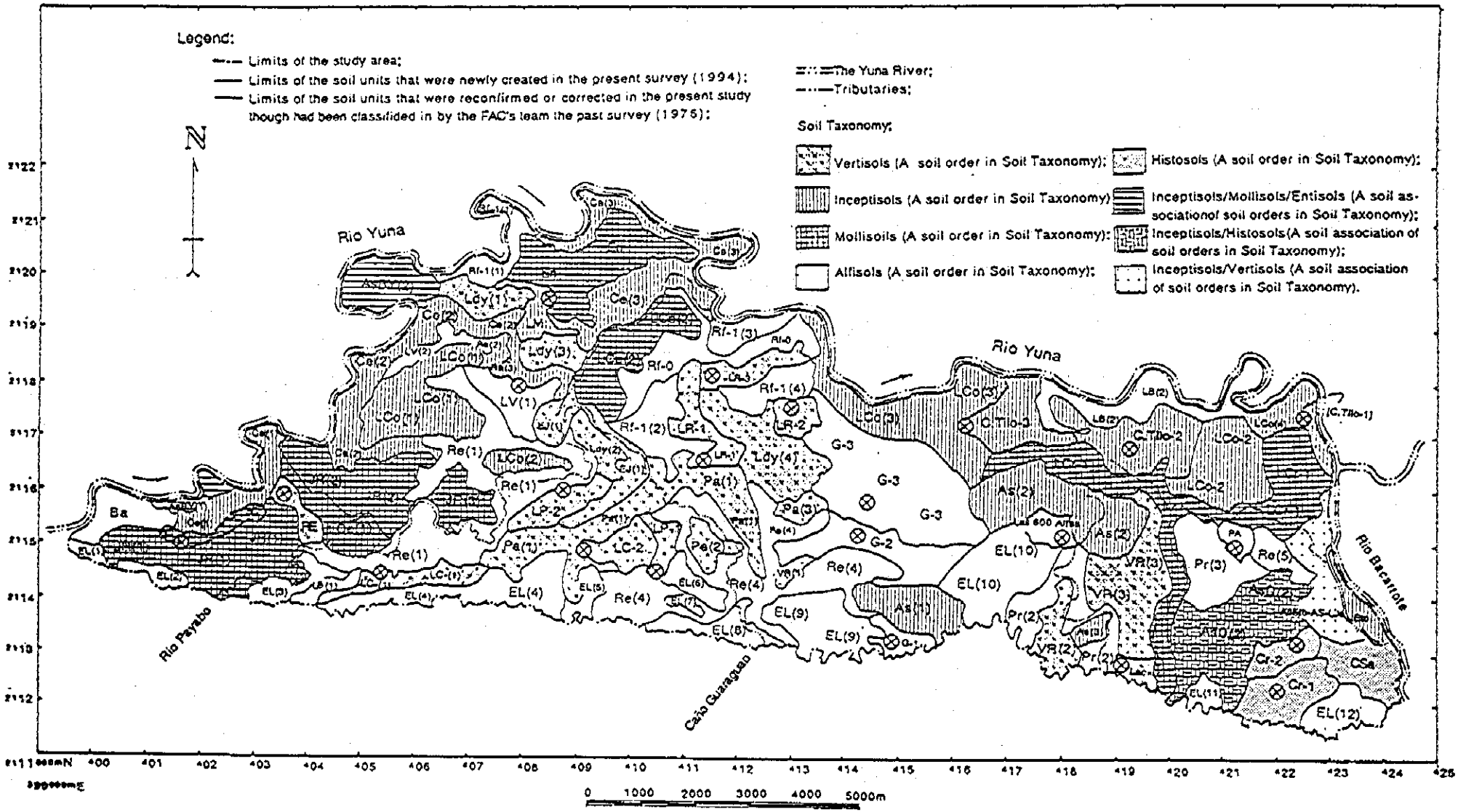

Fig. D.3.1 Soil Classification Map Based on Soil Taxonomy

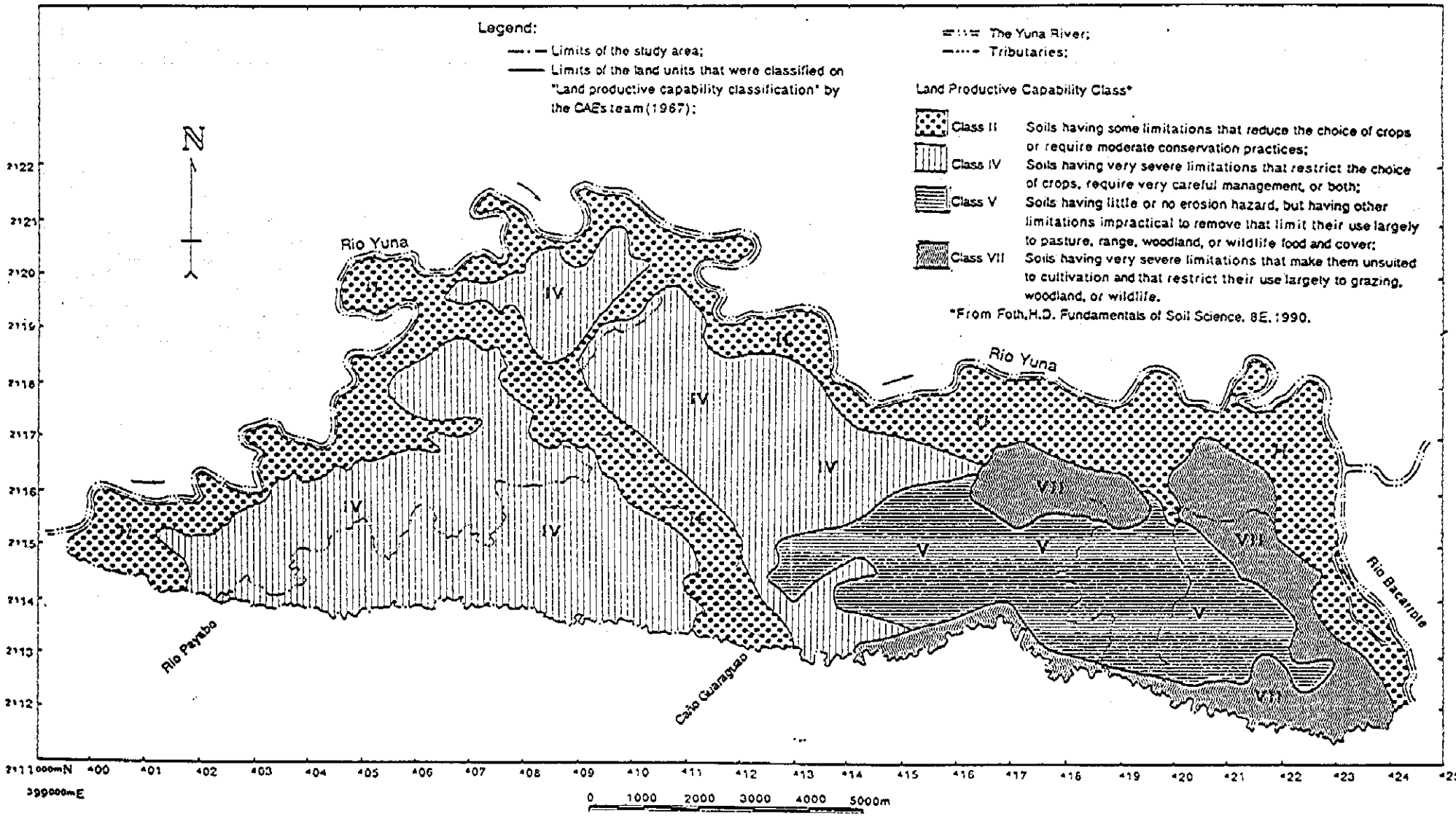

Fig. D.4.1 Land Productive Capability Class Map

(Quoted from OAE. Reconnocimiento y Evaluacion de los Recursos Naturales de la Republica Dominicana.1967)

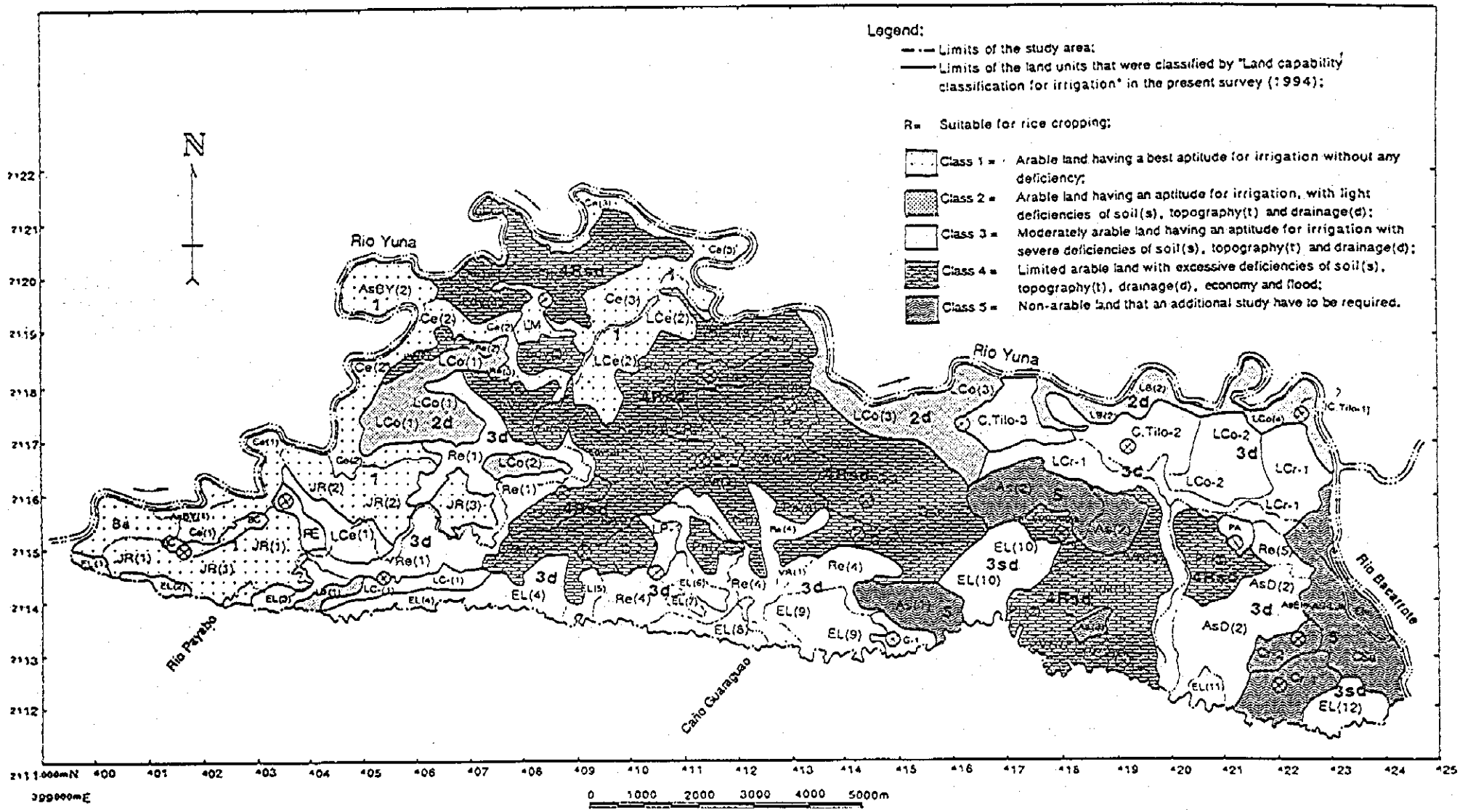

Fig. D.4.2 Land Capability Class Map for Irrigation

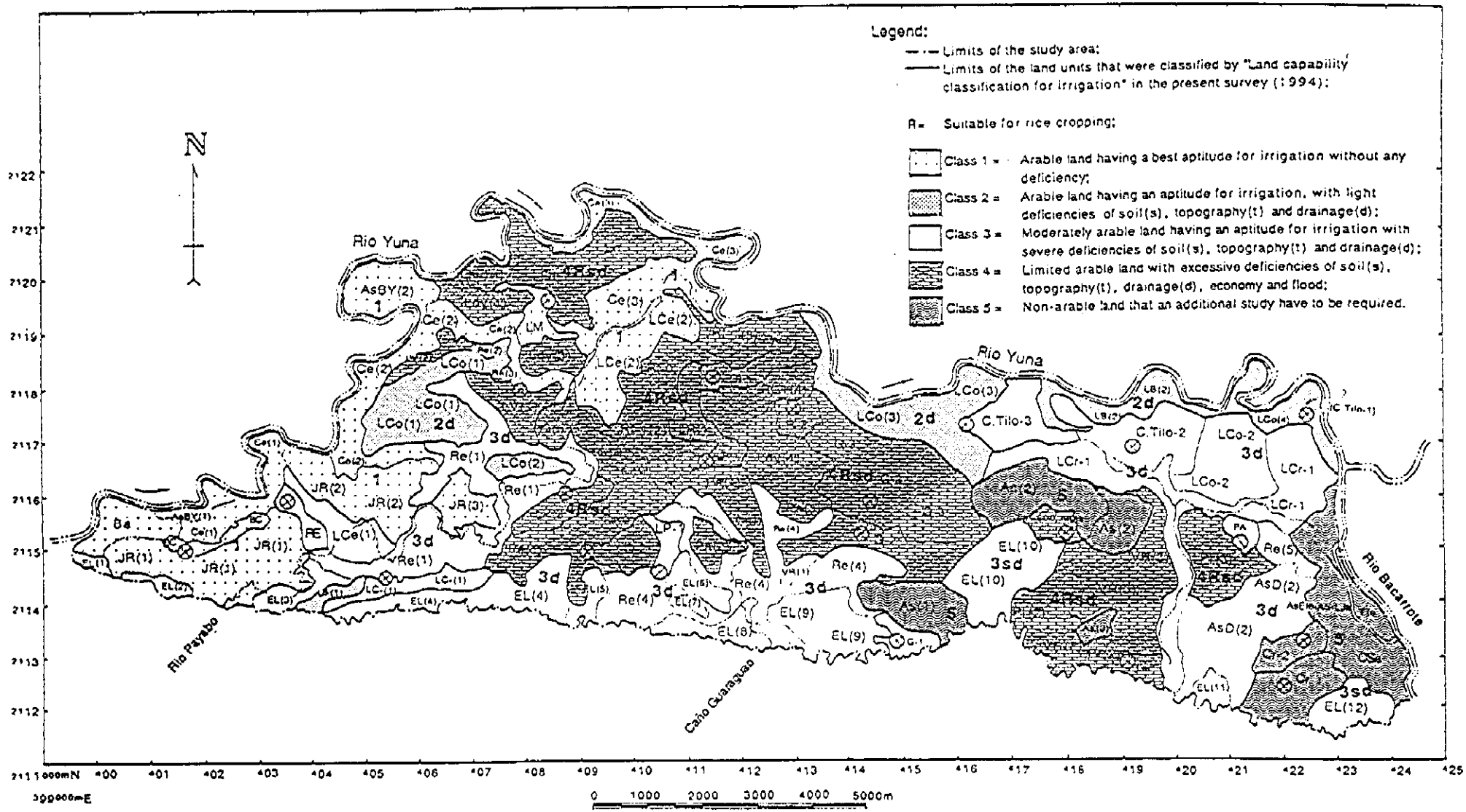

Fig. D.4.2 Land Capability Class Map for Irrigation

ANNEX E : SOCIO-ECONOMIC SURVEY

ANNEX E : SOCIO-ECONOMIC SURVEY

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ANNEX E: SOCIO-ECONOMIC SURVEY

E.1 Introduction

The Limon del Yuna area has been developed as an agrarian reform project area implemented by IAD since 1967, so nearly 70% of the population of the area are represented by the beneficiaries of the IAD's agrarian reform project. There are, on the other hand, owners of extensive private lands who generally use their lands as grazing lands. The principal economic activity of the area is rice production and there are also not a few farmers (both private land owners and beneficiaries of the agrarian reform project) who engage in animal husbandry.

Although irrigation system was provided from the beginning of the agrarian reform project, this system has not been operated and maintained in such manner as to secure farmers with stable rice production. In addition, frequent flooding has prevented farmers from planting rice. Under the circumstances, without attaining promising income, farmers in the area do not enjoy ameliorated standard of life.

With a view to disclose socio-economic feature of the farmers in the Study area, a survey was conducted in the course of the Phase I field work to cover a total of 117 families dispersed over 22 villages in the following manner:

Villages	No. of farmers interviewed
Barraquito	10
Barrio Lindo	3
Borojol	6
Callejon de Tilo	5
Caño Azul	7
Ceiba Abajo	3
Cristal	5
El Laurel	4
Guaraguao	9
Junco Verde	10
La Ceiba	3
La Reforma	9
Las Cuevas	3
Los Arados	3
Los Contreras	5
Los Naranjos	5
Los Peinados	7
Paraguay	7
Payabo	3
Reventazón	10
Total	117

Major topics to have been sounded to farmers in the said survey are as follows:

- General information of interviewee (General characteristics of farmers)
- Residence and provision of social infrastructure
- Land use, cropping pattern, production and marketing of products
- Irrigation system
- Institutional supporting system to farmers (Credit, technical assistance, etc.)
- Rural organization
- Identification of problems on farming and marketing of agro-products

In addition to this survey, in view of the possibility to convert grazing lands into paddy fields with implementation of the Project, supplementary survey on cattle farming was carried out during the Phase II of the field works.

The survey forms are attached as appendix of this annex and the survey result of the survey is compiled in the tables.

E.2 Social Features

The Limon del Yuna agrarian reform project was started in 1967 - 27 years ago, so farmers in the Study area are relatively old with an average age of 48 years. About one to every ten interviewed farmers was female. Regarding with education level of farmers, only 14% of them got education superior to the primary level and farmers who did not attend any school reach 26% of the total.

Major portion (62%) of the settled farmers came from the Province of Duarte, of which 80% had native place within Villa Riva municipality. It is worth while to add that 86% of them came from the Cibao Oriental Region that comprises five provinces: Duarte, Maria Trinidad Sanchez, Salcedo, Samana and Sanchez Ramirez.

Farmers in the area have settled to dedicate to crop farming and animal husbandry, so they depend on income from these activities; about half of the interviewees got income exclusively from sale of crops, animals and milk, meanwhile the rest had derived their income from such activities as working in other farms, employee of public or quasi-public enterprises, engaging in commercial activities, etc. An average gross income per family RD$ 59,771.76/year, which was composed of RD$ 49,733.28 by agricultural and livestock activities and RD$ 10,038 by other activities. Surveyed farmers are classified by their income level in the following manner:

Gross Income Category (Year)	%
More than RD$ 100,000	18
RD$ 75,000~RD$ 99,999	9
RD$ 50,000~RD$ 74,999	14
RD$ 25,000~RD$49,999	26
Less than RD$ 25,000	33

In relation with the type of housing, only 10 of 117 interviewed farmers do not have their own house. And, as for the provision of social infrastructure, the rate of coverage by type of service is as given below.

Potable Water:
- Faucet within house (33%)
- Public faucet (11%)
- Well and/or river (50%)
- Others (6%)

Physiological necessity:
- Flush toilet (10%)
- Latrine within housing plot (82%)
- Public latrine (7%)
- Others (1%)

Electricity:
- CDE (52%)
- Own plant (1%)
- Other energy (1%)
- None (47%)

E.3 Land Tenure and Land Use

So far as the land tenure is concerned, the number of farmlands cultivated by 117 interviewees account for 130 in total (this means that there are 13 farmers who cultivate crops in two farmlands), of which 58% correspond to stall lands distributed by Dominican government to beneficiaries of the agrarian reform. The farmlands cultivated by surveyed farmers, with an average size of 4.55 ha, are grouped by their size and ownership as shown hereinafter.

Farm Size Range	Agrarian Reform Lands	Privately Owned lands	Leased or Other Lands	Total
Smaller than 1 ha	1	7	1	9
1 ha ~ 1.99 ha	12	7	0	19
2 ha ~ 3.99 ha	56	13	8	77
4 ha ~ 5.99 ha	5	1	3	9
6 ha ~ 11.99 ha	2	6	1	9
12 ha ~ 24.99 ha	0	3	0	3
Larger than 25 ha	0	4	0	4
Total	76	41	13	130

With regard to privately owned farmlands, there presents imbalance in terms of farm size by ownership; 17% of privately owned lands range larger than 12 ha, while 34% of these lands are smaller than 2 ha. By contrast, agrarian reform lands are, by their nature, characterized by their similar size (about 90% of them are concentrated in the range of 1-4 ha). There are some beneficiaries of agrarian reform who answered that they are cultivating lands with area superior to 60 tareas (3.77 ha), but taking account that the maximum area of land to be distributed under the agrarian reform project is limited to 60 tareas, they are engaging in farming activity in lands which are illegally leased by other settlers. Farmers who have settled at newly developed agrarian reform area of La Ceiba de los Pajaros are distributed smaller lands (around 2 ha) than those have settled originally.

The Study area has been developed as an area for rice production, so paddy fields occupy the greater portion (67%) within the context of the land use and grazing lands follow with the

coverage of 20%. Lands used for permanent and annual crops are insignificant with a proportion of 3.9% and 3.6%, respectively. Around 5% of the lands are left as fallow or idle lands without crops.

E.4 Farming Practice

Due to lack of financial arrangement as well as deficient access to irrigation water, not a total paddy fields filled with plants. It is revealed that the cropping intensity of paddy fields among interviewed farmers remains relatively low: 70% for the first cropping semester and 53 for the second cropping semester.

The unit yield of paddy among interviewed farmers was 3.75 ton/ha. Approximately 16% of the harvested rice is consumed by farmers and their family members. The proportion of the harvested rice which are sold within the Study area was 57%. For the year of 1993, paddy are sold at RD$ 302/qq (RD$ 6,565/ton) in the Study area.

So far as livestock is concerned, cattle farming is the leading activity, while swine and poultry are bred in small scale, mostly to support household economy of farmers who engage in crop production. The great majority of animals are sold within the Study area from farmers to middlemen.

Almost all interviewed farmers answered that cultural activities relevant to crop production are done by both farmers (including their family members) and hired labors; an average number of persons who work at fields are: 2.2 (family member) and 13.2 (hired labor). About half (52%) of the interviewees employed labor force on a contract basis. The man-days consumed for respective farm labor are as follows:

Farm Labor Item	Man-day
Sowing	50.9
Transplanting	94.5
Application of fertilizer	4.3
Application of agro-chemicals	8.2
Plowing	9.7
Leveling	6.3
Maintenance of canal	2.6
Construction of ridge	14.6
Irrigation	3.1
Harvest	16.1

The average wage paid to hired labor was around RD$ 100/day.

With regard to use of agricultural machinery/equipment (animal), the survey revealed the following result.

Machinery/equipment	Farmers' Ownership (%)	Hired (%)	No Use (%)
Tractor	1	66	33
Motor cultivator	4	71	25
Fumigation pump	33	58	9
Irrigation pump	21	15	64
Animal	3	74	23

In sum, 91% of farmers who were interviewed depend on their farming activities on machinery and/or equipment and 81% of them use animals, meanwhile only 9% of the interviewees carry out crop cultivation using exclusively manpower.

Regarding irrigation system, 88% of the interviewed farmers had access to irrigation water, and 31% of them take water to irrigate their paddy fields by means of pumping system. As for sources of irrigation water, 36% of farmers intake water from rivers, 56% from canals, and 3% for wells.

E.5 Institutional Supporting Services to Farmers

The greater part of farmers in the Study area do not have sufficient financial resources, therefore farmers have no way but to depend on credit services to realize their crop production. As mentioned before, the cropping intensity among interviewed farmers remains relatively low and one of the reason for this low cropping intensity may be identified as lack of financial resources. According to the survey to farmers, about 30% of farmers could not get credit needed to purchase agricultural imputs. On the other hand, of farmers who got credit services, 84% were from the Agricultural Bank (BAGRICOLA) and 15% were from sources other than banks such as rice mills, relatives, etc.; only one farmer among the 117 interviewees got credit from commercial bank. The amount of agricultural credit was RD$ 1,068/ta (RD$ 16,981/ha) on average with a period of 6 months.

The extension services or transfer of technology from governmental officials to farmers is an important factor if farmers desire to attain sustainable crop production as well as higher level of yield.

Nearly half of the farmers in the area had experience in participating some training course on cropping technology. In addition, 87% of them received technical assistance services either from governmental officials or private experts and 72% of them evaluated these technical assistance services to be useful. Farmers received technical training or extension services on the following disciplines, namely:

Discipline	% of Farmers Received
Insects and disease control	73
Weeds control	71
Land preparation	38
Sowing and transplanting	20
Harvest	19
Practice of soil conservation	10
Marketing	8
Rural organization	4

E.6 Rural Organization

The Government of the Dominican Republic encourages rural population to participate any kind of organization and in line with this promotion, 72% of the interviewees belong to some organizations. The major reason why farmers in the Study area are affiliated with association and/or cooperative is that settlers without land ownership confront difficulty in getting finance for their farming activity if they are not member of any association or cooperative.

E.7 Identification of Problems on Crop Production and Marketing; Intention of Farmers

The interviewed farmers identify problems related with their farming practice in the following manner.

IDENTIFICATION OF PROBLEMS	AFFIRMATIVE PERCENTAGE
1. Elevated price of inputs	95
2. Access to credit	91
3. Acquisition of quality seed	83
4. Limited farm size	75
5. Availability of inputs	74
6. Irrigation system	52
7. Technical assistance	50
8. Availability of irrigation water	50
9. Lands inundation	32
10. Labor force	20
11. Profitability of crop production	17
12. Land fertility	14

On the other land, problems concerned with marketing of agro-products are posed as figured below.

IDENTIFICATION OF PROBLEMS	AFFIRMATIVE PERCENTAGE
1. Drastic fluctuation of farm-gate price	94
2. Prolonged period for payment	73
3. Transportation method	65
4. Negotiating capacity with buyers	65
5. Lack of processing facilities	56

Despite the said problems prevail, the great majority (93%) of the surveyed farmers in the Study area intend to continue to cultivate their farming activity with actual crops, because: 1) Better accessibility to credit service, 2) Familiarity with cropping technique, 3) Adaptability of soil condition, 4) Lack of information and technical assistance on other crops, and so on. Nearly four-fifths of the interviewees answered that they are satisfied with the actual crops, simply because they live at least on them.

E.8 Supplementary Survey on Cattle Farming

During the phase II of the field works, in view that the development plan under the present Study pretends to convert grazing lands into paddy fields, supplementary survey on cattle farming was carried out and this survey disclosed the livestock activity in the area in the following manner:

- Average pasture area: 9.0 ha
- Percentage of improved pasture: 48%
- No. of head per has of pasture: 7.1 heads/ha
- Weight at the time of weaning: 62 kg
- Interval between deliveries: 15 months
- Milk production: 5.41 l/head/day
- Duration for milk production: 177 days
- Fattening rate: 600 grams/day

In accordance with the above coefficient, the balance of livestock activity in the Study area was estimated on average as follows:

- Annual gross Income: RD$ 20,065/ha
- Annual production cost including depreciation for initial investment: RD$ 10,901/ha
- Net annual return: RD$ 9,164/ha

Finally, it is worth while to indicate that half of the interviewed farmers answered that they are willing to convert their pasture into paddy fields if their lands have access to irrigation water.

ANNEX E : TABLES

Table E.2.1 Summary of Socio-economic Survey
- General Information -

Villages	No. of Interviewees	Head of the Family						Year of Residence	Native Place		Proceeding from		Family Member	Gross Annual Income (1993)		
		Sex		Age	Education Level				Prov. Duarte	Others	Prov. Duarte	Others		Agriculture	Others	Total
		Male (%)	Fem.(%)		Prim.(%)	Sec.(%)	None(%)		(%)	(%)	(%)	(%)		(RD$)	(RD$)	(RD$)
La Reforma	9	100	0	53	60	20	20	23	67	33	78	22	5	124,045.00	2,267.00	126,312.00
Barraquito	10	80	20	55	50	10	40	25	10	90	10	90	7	24,214.00	5,238.00	29,452.00
Guaraguao	9	100	0	48	89	0	11	19	22	78	33	67	6	80,258.00	6,111.00	86,369.00
Cristal	5	100	0	51	40	20	40	20	20	80	80	20	7	28,591.00	3,920.00	32,511.00
Borojol	6	83	17	40	50	50	0	33	83	17	83	17	5	30,467.00	8,200.00	38,667.00
Paraguay	7	100	0	55	43	29	28	24	29	71	43	57	4	29,771.00	39,143.00	68,914.00
Callejon de Tilo	5	80	20	46	60	20	20	41	80	20	80	20	6	119,025.00	28,688.00	147,713.00
Los Naranjos	5	60	40	47	60	20	20	19	100	0	100	0	7	11,500.00	15,120.00	26,620.00
Los Contreras	5	100	0	37	80	0	20	22	40	60	80	20	5	32,750.00	3,750.00	36,500.00
Cano Azul	7	86	14	47	86	0	14	17	71	29	57	43	5	42,583.00	3,857.00	46,440.00
Junco Verde	10	80	20	42	50	30	20	38	90	10	80	20	6	52,455.00	8,578.00	61,033.00
Los Peinados	7	100	0	44	43	14	43	16	100	0	86	14	6	31,980.00	0.00	31,980.00
Reventazon	10	90	10	47	50	10	40	38	90	10	90	10	6	40,780.00	16,015.00	56,795.00
Others	22	95	5	52	68	4	28	38	68	32	64	36	6	47,593.00	8,867.00	56,460.00
Total (Average)	**117**	**91**	**9**	**48**	**60**	**14**	**26**	**29**	**62**	**38**	**66**	**34**	**6**	**49,733.28**	**10,038.48**	**59,771.76**

Table E.2.2 Summary of Socio-economic Survey
- Housing and Basic Social Services -

Villages	No. of Interviewees	Tipe of Housing			Source of Water Supply				Fisiological Necessity			Electric Supply		
		Own	Rented	Ocupaied W/o pay	Domestic Faucet	Public Faucet	River or Well	Others	Flush Toilte	Domestic Letrine	Public Letrine	CDE	Own Plant	None
La Reforma	9	78	11	11	78	11	11	0	22	78	0	100	0	0
Barraquito	10	80	10	10	70	30	0	0	0	90	10	100	0	0
Guaraguao	9	100	0	0	56	33	11	0	0	67	33	100	0	
Cristal	5	100	0	0	0	0	100	0	0	100	0	0	0	100
Borojol	6	100	0	0	0	0	100	0	0	100	0	100	0	0
Paraguay	7	86	14	0	43	43	0	14	14	71	14	86	0	14
Callejon de Tilo	5	100	0	0	20	0	80	0	20	80	0	100	0	0
Los Naranios	5	100	0	0	0	0	100	0	0	100	0	0	0	100
Los Contreras	5	100	0	0	20	0	60	20	0	100	0	20	0	80
Cano Azul	7	100	0	0	14	0	57	29	0	57	43	14	0	86
Junco Verde	10	70	10	20	60	20	0	20	0	100	0	0	10	90
Los Peinados	7	100	0	0	58	14	14	14	0	100	0	57	0	43
Reventazon	10	100	0	0	0	0	100	0	80	20	0	0	0	100
Otros	22	90	5	5	18	0	82	0	0	100	0	45	0	55
Total (Average)	117	92	4	4	33	11	50	6	10	83	7	52	1	47

Table E.3.1 Summary of socio-economic Survey
- Land Tenure and Land Use -

(1) Land Tenure

Unit: ha

Villages	Privately Owned Land			Agrarian Reform Lands			Leased or Other Lands		
	No. of Farmland	Total Area	Area per Farmland	No. of Farmland	Total Area	Area per Farmland	No. of Farmland	Total Area	Area per Farmland
La Reforma	1	1.89	1.89	8	35.85	4.48	1	18.87	18.87
Barraquito	3	9.43	3.14	6	25.72	4.29	2	7.55	3.78
Guaraguao	0	0.00	0.00	9	30.13	3.35	0	0.00	0.00
Cristal	2	3.58	1.79	4	11.13	2.78	0	0.00	0.00
Borojol	6	22.33	3.72	1	1.26	1.26	0	0.00	0.00
Paraguay	2	30.19	15.10	5	14.47	2.89	1	4.72	4.72
Callejon de Tilo	3	82.33	27.44	2	6.48	3.24	0	0.00	0.00
Los Naranjos	2	2.20	1.10	4	6.42	1.61	0	0.00	0.00
Los Contreras	0	0.00	0.00	4	10.63	2.66	1	3.77	3.77
Cano Azul	2	5.97	2.99	5	17.30	3.46	0	0.00	0.00
Junco Verde	7	50.82	7.26	3	5.09	1.70	1	4.40	4.40
Los Peinados	1	3.65	3.65	6	19.18	3.20	0	0.00	0.00
Reventazon	4	28.81	7.20	8	18.81	2.35	0	0.00	0.00
Others	8	60.75	7.59	10	41.38	4.14	3	8.05	2.68
Total	41	301.95	7.36	75	243.85	3.25	9	47.36	5.26

(2) Land Use

Unit: ha

Villages	Paddy	Anual Crops	Permanent Crops	Fallow or Idle Lands	Pasture	Forest or Bush	Others	Total Area
La Reforma	42.14	1.26	5.03	1.26	0.00	0.00	0.00	49.69
Barraquito	34.53	1.51	0.00	3.02	3.77	0.00	0.00	42.83
Guaraguao	33.27	0.00	0.00	0.00	0.00	0.00	0.00	33.27
Cristal	11.13	0.00	0.00	3.14	0.00	0.00	0.00	14.27
Borojol	13.21	0.00	1.89	0.00	8.49	0.00	0.00	23.59
Paraguay	13.84	0.00	0.00	3.14	32.39	0.00	0.00	49.37
Callejon de Tilo	30.69	7.74	2.52	0.00	47.48	0.00	0.00	88.43
Los Naranjos	7.67	0.00	0.94	0.00	0.00	0.00	0.00	8.61
Los Contreras	12.52	0.94	0.00	0.00	0.00	0.94	0.00	14.40
Cano Azul	19.50	0.00	0.00	0.00	3.77	0.00	0.00	23.27
Junco Verde	53.21	2.52	1.89	0.00	4.72	0.00	0.00	62.34
Los Peinados	22.83	0.00	0.00	0.00	0.00	0.00	0.00	22.83
Reventazon	31.38	0.00	0.50	0.00	15.72	0.00	0.00	47.60
Others	69.69	6.35	10.50	17.67	3.77	0.00	1.89	109.87
Total	395.61	20.32	23.27	28.23	120.11	0.94	1.89	590.37

Table E.4.1 Summary of Socio-economic Survey
- Production and Marketing of Crops -

		Crops Production						Marketing			
		Semester A 1993			Semester B						
Villages	Crops	Planted Area (Tarea)	Harvest Area (Tarea)	Production (Quintal)	Planted Area (Tarea)	Harvest Area (Tarea)	Production (Quintal)	Volume Sold (Quintal)	Price ($/qq)	Sold to Study Area	Sold to Out of Area
Reforma	Paddy	670	670	2,907	600	600	2,671	5,344	272	30	60
	Cacao	80	80	82	80	80	82	164	588	0	100
Barraquito	Paddy	380	380	1,299	120	120	388	1,605	353	60	40
Guaraguao	Paddy	469	469	1,663	369	369	1,126	2,713	430	100	0
Cristal	Paddy	142	142	552	92	92	440	940	231	80	20
	Plantain (Bunch)	7	8	400	7		500	400	20	100	0
Borojol	Paddy	140	140	991	140	140	1,066	1,553	261	33	67
	Coconut (x000)	10	10	3	10	10	2	4	300	100	0
	Plantain (x000)	20	20	6				2	400	100	0
Paraguay	Paddy	125	125	615	155	155	743	1,281	283	100	0
Callejon de Tilo	Paddy	273	273	1,407	200	200	1,575	2,917	230	100	0
	Cacao	6	6	4				4	400	100	0
	Plantain (x000)	98	98	11	3	3	1	6	600	100	0
	Maize	30	15	60							
Los Naranjos	Paddy	82	82	158	35	35	146	275	258	67	33
	Plantain (x000)	15	15	36				33	400	100	0
Los contreras	Paddy	165	165	835	74	74	450	1,182	247	0	100
Cano azul	Paddy	200	200	1,393	130	130	974	1,718	233	20	80
Junco Verde	Paddy	395	395	2,566	261	261	1,744	4,825	229	64	36
	Plantain (x000)	70	70	37				144		100	0
	Cacao	40	40	25				25	520	0	100
Los Peinados	Paddy	263	203	908	193	193	1,097	1,875	257	57	43
Reventazon	Paddy	335	335	1,687	96	96	668	2,213	283	0	100
0	Plantain (x000)	8	8					100			
	Pasture	250									
Others	Paddy	721	721	3,691	851	851	5,457	4,269	229	50	50
	Sweet Potato	10	10	70				35	150	100	0
	Cassava	4	4	25				18	125	100	0
	Cacao	80	80	40				40	475	50	50
	Sweet Pepper	7	7	18	7	7	30	48	200	0	100
	Plantain (x000)	35	35		35	35		2	600	100	0
	Maize	80	80	60	80	80	144	200	175	50	50
Total	Paddy	4,360	4,300	20,672	3,316	3,316	18,545	32,709	302	56.86275	51.96078
	Cacao	206	206	151	80	80	82				
	Plantain (x000)	233	234		45	38					
	Coconut	10	10	3	10	10	2				
	Maize	110	95	120	80	80	144				
	Pasture	250	0	0	0	0	0				
	Sweet Potato	10	10	70	0	0	0				
	Cassava	4	4	25	0	0	0				

Table E.4.2 Summary of Socio-economic Survey
- Production and Marketing of Livestock -

	Raising of Animal		Dairy Farming				Marketing of Animals				
					Marketing Place					Marketing Place	
Villages	Type of Animals	Heads	Q'ty Sold (Galon)	Price ($/gl)	Study Area	Out of Area	Type of Animals	Sold Heads	Price ($/Head)	Study Area	Out of the Area
Reforma	Poultry	153									
	Cattle	25					Cattle	4	4,250	0	100
Barraquito	Poultry	54	90	231.25	100	0	Cattle	5	5875	50	50
	Cattle	28					Swine	6	4720	100	0
	Swine	4									
	Equine	3									
Guaraguao	Poultry	150	37.2	12	100	0	Swine	6	1650	100	0
	Cattle	4									
	Swine	7									
Cristal	Poultry	60	84.4	8	100	0	Cattle	1	5000	100	0
	Cattle	6					Cattle	2	4000	100	0
	Swine	4					Swine	6	3600	100	0
	Equine	8					Sheep	4	600	100	0
	Sheep	4									
Borojol	Poultry	92	147.7	12.25	100	0	Cattle	22	3550	50	50
	Cattle	60					Cattle	1	2700	100	0
	Swine	9					Swine	9	1950	100	0
	Equine	12					Poultry	20	30	100	0
paraguay	Poultry	75	440.7	10.85	100	0	Cattle	8	4000	0	100
	Cattle	93					Swine	2	1500	0	100
	Swine	2									
	Equine	9									
	Sheet	2									
Callejon de Tilo	Poultry	61	179.4	13	100	0	Cattle	12	6000	100	0
	Cattle	106					Cattle	28	3000	100	0
	Swine	6					Swine	6		100	0
	Equine	84									
	Sheep										
Los Naranjos	Poultry	18	14.9	10	100	0	Cattle	4	2750	50	50
	Cattle	8									
	Swine	3									
	Equine	6									
Los contreras	Poultry	18					Swine	2	2000	100	0
	Swine	2									
	Equine	5									
Cano azul	Poultry	14					Cattle	4	2500	100	0
	Cattle	13					Cattle	2	2000	0	100
	Swine	2					Sheep	19	300	100	0
	Equine	2									
Junco Verde	Poultry	127	310	13.5	100	0	Cattle	12	3500	100	0
	Cattle	96					Swine	30	475	100	0
	Swine	5									
	Equine	5									
	Sheep	1									
Los Peinados	Poultry	81					Poultry	10	42	100	0
	Cattle	1					Swine	7	1000	100	0
	Swine	4									
	Equine	1									
Reventazon	Poultry	164					Cattle	50	2000	0	100
	Cattle	107					Swine	23	1250	100	0
	Swine	23									
	Equine	13									
Others	Poultry	312	624.8	11	100	0	Cattle	6	1300	50	50
	Cattle	29					Cattle	1	6000	100	0
	Swine	27					Swine	16	1630	100	0
	Equine	29									
	Sheep	1									
Total	Poultry	1379	1929.1	36.17378	100	0					
	Cattle	576	0								
	Swine	98	0								
	Equine	177	0								
	Sheep	8	0								

Table E.4.3 Summary of Socio-economic Survey
- Farm Labor -

Villages	Farm Labor is done by		No. of Labor Working on Farm		Contract		Free of Charge		Partiopation of Hired Labor												Daily Payment
	Family (%)	Hired (%)	Family	Hired	Yes (%)	No (%)	Yes (%)	No (%)	Sowing M/D	Cleaning M/D	Fertilizer M/D	Fungicide M/D	Insecticide M/D	Herbicide M/D	Plowing M/D	Leveling M/D	Channel M/D	Ridge M/D	Irrigation M/D	Harvest M/D	(RD$)
La Reforma	100	100	1.9	28.6	67	33	0	100	71.4	76.1	2.1	2	2.5	5	11.4	7	6	28.6	30.7	20.7	104.3
Barraquito	90	100	2	26.6	75	25	14	86	60.4	123.7	2.5	1.5	3.7	2.2	1	2.3	0	13	0	2.7	95.6
Guarano	89	100	2.3	35.5	67	33	17	83	80	127.7	4.2	2	3.3	3.2	8	3.2	0	13.2	0	7.7	85
Cristal	100	100	2	14	33	67	0	100	30	31.7	1	1	1.5	1	16	4	0	16	2	60.5	90
Boronol	83	83	1.6	10	17	83	0	100	5.8	57.5	3.3	3	0	2.3	11.7	2	0	8.7	1	3	88.7
Paraguay	100	100	1.2	28.8	33	67	0	100	1.5	48.2	1.7	1.5	1.5	2	13.7	3.5	0	4.3	0	7.8	100.8
Callejon de Tilo	100	100	1.2	75	75	25	25	75	119.8	118.3	6.7	2	3.5	0	16	96.7	0	4	15	8	87.5
Los Naranjos	100	100	2	15.7	67	33	0	100	11	21.3	1.2	1.2	1.2	1.2	1	21	0	6	0	6.5	80
Los Contreras	100	100	2.7	60.2	40	60	0	100	41.5	44.2	1.9	3	3	1.7	3.7	2.2	0	11	0	8.7	92
Cano Azul	100	100	2.7	11.6	100	0	0	100	38.5	108.3	2	2.5	2	2	4.3	3	20	17.5	0	5.5	100
Junco Verde	100	100	1.3	23	78	22	14	86	68.5	240.8	10	2	1.2	2.4	164.7	8.2	4	9.8	0	26.2	93.7
Los Penados	100	100	2	13	100	0	17	83	23.8	59.7	2	2	2	2.3	14	3	0	20.5	0	0	88.7
Reventazon	100	100	7.3	15.7	50	50	0	100	47.2	41.4	3	4.6	4.2	4.2	5.2	2.5	0	11.5	0	11	89.4
Others	90	86	2.2	13.2	52	48	6	94	60.6	101.3	3.4	3	3.1	6.8	11.7	12.6	3	20.8	0	16.1	96.5
Total (Average)	91.3	46.5	2.4	23.9	61.4	38.6	6.9	93.1	50.9	94.5	4.3	2.4	2.5	3.3	9.7	6.3	2.6	14.6	3.1	16.1	100.9

Table E.4.4 Summary of Socio-economic Survey
- Means for Farming -

Villages	No. of Interviewees	Means for Farming Employed										Employed Force			Irrigation Method			Water Resources		
		Tractor		Animal Plowing		Motor Cultivat		Fumigation Pump		Irrigation Pump										
		Own	Hired	Own	Hired	Own	Hired	Own	Hired	Own	Hired	Animal	Mecha-nical	Only Mankind	Gravity	Pump	No	River	Canal	Well
La Reforma	9	11	89	0	100	22	78	56	44	44	56	100	100	0	56	44	0	44	67	0
Barraquito	10	0	100	0	70	0	50	60	40	0	30	70	100	0	70	30	0	30	70	0
Guaraguao	9	0	89	0	44	0	89	33	56	11	22	100	100	0	67	33	0	78	44	0
Cristal	5	0	80	0	100	0	80	40	40	0	0	100	100	0	60	0	40	40	40	20
Borojol	6	0	50	17	67	17	67	50	50	50	67	83	83	17	17	67	17	67	17	0
Paraguay	7	0	57	0	71	0	71	57	43	0	0	71	71	29	100	0	0	29	57	14
Callejon de Tilo	5	0	60	0	80	20	40	0	60	20	20	80	80	20	40	40	20	40	40	0
Los Naranjos	5	0	20	0	40	0	40	0	80	0	0	60	60	40	40	20	40	0	60	0
Los Contreras	5	0	80	0	100	0	80	20	80	0	0	100	100	0	100	0	0	20	80	0
Cano Azul	7	0	57	0	86	0	71	29	57	0	0	86	86	14	86	0	14	14	71	0
Junco Verde	10	0	50	0	90	0	90	60	40	30	0	100	100	0	60	30	10	20	70	0
Los Pemados	7	0	86	0	86	0	100	29	71	57	0	100	100	0	29	57	14	43	57	0
Reventazon	10	0	40	10	70	10	60	30	60	30	10	90	90	10	40	40	10	30	60	0
Others	22	0	59	5	68	0	68	9	77	27	9	73	86	9	50	36	14	36	45	5
Total (Average)	117	1	66	3	75	4	71	33	58	21	15	85	91	9	57	31	11	36	56	3

TAble E.5.1 Summary of Socio-economic Survey
- Credit Services -

Villages	No. of Interviewees	Agricultural Credit					
		Institutions			Without Credit	Amount (RD$/ta)	Period (Month)
		Banco Agricola	Other Banks	Others			
La Reforma	9	44	0	22	33	791	6.00
Barraquito	10	80	0	0	20	981	5.88
Guaraguao	9	67	0	0	33	990	6.00
Cristal	5	60	0	0	40	949	6.00
Borojol	6	17	0	17	67	1.140	6.00
Paraguav	7	71	0	0	29	1.090	6.00
Callejon de Tilo	5	40	20	20	20	2.318	6.50
Los Naranjos	5	60	0	0	40	900	6.00
Los Contreras	5	80	0	0	20	858	6.00
Cano Azul	7	71	0	0	29	910	6.00
Junco Verde	10	60	0	20	20	1.022	5.88
Los Peinados	7	86	0	0	14	922	6.00
Reventazon	10	50	0	20	30	1.658	5.86
Others	22	50	0	18	32	905	5.80
Total (Average)	**117**	**59**	**1**	**10**	**30**	**1,068**	**5.95**

Table E.5.2 Summary of Socio-economic Survey
- Training and Technical Assistance -

Villages	No. of Interviewees	Experience on participating in technical training course		Experience on receiving technical advises from			Assistance from agronomists of the Government last year			Fields of Training and Technical Assistance								
		Yes	No	Private Agronom.	Agronomist of the Government	Others	Useful	Not Useful	Not received	Practice of Soil Conservation	Harvest	Land Preparation	Marketing	Sowing	Organization	Weeds Control	Insects and disease Control	None
La Reforma	9	67	33	0	89	11	78	11	11	11	22	33	11	22	0	78	89	11
Barraquito	10	50	50	10	90	10	40	40	20	30	30	50	30	50	0	100	100	0
Guaraguao	9	78	22	22	100	22	67	22	11	11	33	44	11	22	22	100	100	0
Cristal	5	80	20	20	80	20	40	40	20	20	20	60	40	60	0	100	100	0
Borojol	6	0	100	33	33	50	33	17	50	0	17	17	0	0	0	50	50	33
Paraguay	7	57	43	14	71	40	43	14	43	0	29	29	0	0	0	57	57	29
Callejon de Tilo	5	0	100	20	60	20	40	60	0	0	20	40	0	20	0	40	60	0
Los Naranjos	5	60	40	0	60	40	60	0	40	20	0	40	0	0	0	60	40	40
Los Contreras	5	100	0	0	100	0	60	20	20	0	0	60	0	20	0	80	100	0
Cano Azul	7	71	29	14	71	14	86	14	0	14	71	43	14	43	43	57	57	0
Junco Verde	10	30	70	10	80	10	80	10	10	10	10	40	0	40	0	70	70	10
Los Peinados	7	14	86	0	100	0	57	29	14	0	14	14	14	29	0	57	57	0
Reventazon	10	50	50	50	40	10	90	0	10	20	0	60	0	0	0	80	80	10
Others	22	41	59	9	55	27	32	27	41	5	9	27	0	0	0	59	59	18
Average	117	49	51	15	72	19	56	21	22	10	19	38	8	20	4	71	73	13

Table E.6.1 Summary of Socio-economic Survey
- Rural Organization -

Villages	No. of Interviewees	Participate in some organization		Type of Organization			Type of Productive Activities which are done through organization							
		Yes	No	Rural	Cooperative	Others	Marketing	Machin.	Storage	Inputs	Transp.	Training	Credit	None
La Reforma	9	56	44	67	22	67	11	33	11	33	22	56	22	33
Barraquito	10	90	10	80	70	70	50	60	0	80	40	40	70	0
Guaraguao	9	89	11	78	22	67	33	56	11	56	56	22	44	11
Cristal	5	100	0	80	60	40	60	60	20	80	60	100	80	0
Borojol	6	33	67	33	0	17	17	17	0	0	0	0	0	50
Paraguay	7	86	14	29	86	43	0	29	0	14	0	0	43	29
Callejon de Tilo	5	40	60	20	20	40	0	20	0	40	0	20	20	20
Los Naranjos	5	80	20	80	20	0	0	20	0	20	0	20	60	20
Los Contreras	5	100	0	40	80	40	0	40	0	40	0	60	100	0
Cano Azul	7	86	14	29	57	14	43	43	0	71	0	43	71	14
Junco Verde	10	50	50	50	10	40	0	40	0	40	10	30	50	20
Los Peinados	7	86	14	71	57	0	57	71	0	86	0	29	86	0
Reventazon	10	70	30	60	0	40	0	20	0	20	0	20	60	30
Others	22	64	36	41	36	32	9	18	5	18	5	18	50	18
Average	**117**	**72**	**28**	**54**	**37**	**38**	**19**	**36**	**3**	**40**	**14**	**30**	**53**	**18**

Table E.7.1 Summary of Socio-economic Survey
- Identification of Problems -

(1) Farming System

Villages	No. of Interviewer	Profitability of Crops		Fertility of Soils		Availability of Water		Land Inundation		Irrigation System		Farm Size		Technical Assistance		Availability of Inputs		Price of Inputs		Agricultural Credit		Labor Force		Acquisition of Seeds	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
La Reforma	9	11	89	11	89	71	29	22	78	67	33	67	33	22	78	89	11	100	0	75	25	25	75	86	14
Barraquito	10	0	100	0	100	22	78	50	50	33	67	50	50	40	60	80	20	100	0	80	20	33	67	90	10
Guaraguao	9	29	71	29	71	0	100	71	29	71	29	75	25	56	44	44	56	100	0	100	0	22	78	89	11
Cristal	5	40	60	40	60	0	100	20	80	20	80	80	20	60	40	60	40	100	0	100	0	50	50	100	0
Borojol	6	33	67	0	100	50	50	0	100	20	80	100	0	67	33	60	40	100	0	100	0	0	100	100	0
Paraguay	7	29	71	29	71	43	57	29	71	29	71	71	29	43	57	71	29	71	29	86	14	0	100	71	29
Callejon de Tilo	5	0	100	0	100	40	60	25	75	75	25	100	0	100	0	60	40	100	0	100	0	0	100	100	0
Los Naranjos	5	40	60	40	60	60	40	60	40	67	33	100	0	80	20	60	40	75	25	75	25	20	80	40	60
Los Contreras	5	0	100	0	100	20	80	40	60	0	100	60	40	20	80	100	0	100	0	100	0	25	75	100	0
Cano Azul	7	29	71	29	71	71	29	43	57	71	29	86	14	57	43	86	14	100	0	100	0	43	57	67	33
Junco Verde	10	10	90	10	90	60	40	30	70	70	30	90	10	30	70	80	20	90	10	80	20	10	90	90	10
Los Peinados	7	14	86	0	100	100	0	57	43	43	57	71	29	14	86	86	14	100	0	100	0	14	86	86	14
Reventazon	10	10	90	0	100	70	30	11	89	70	30	80	20	70	30	100	0	100	0	80	20	10	90	90	10
Others	22	14	86	19	81	57	43	14	86	55	45	57	43	57	43	67	33	95	5	100	0	25	75	74	26
Total	117	17	83	14	86	50	50	32	68	52	48	74	26	50	50	75	25	95	5	91	9	20	80	83	17

(2) Marketing of Agro-products

Villages	No. of Interviewer	Fluctuation of Prices		Period for Payment		Lack of Installations		Means of Transportation		Negotiating Capacity	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
La Reforma	9	100	0	100	0	75	25	75	25	50	50
Barraquito	10	90	10	67	33	60	40	70	30	80	20
Guaraguao	9	100	0	100	0	78	22	89	11	89	11
Cristal	5	100	0	100	0	80	20	80	20	100	0
Borojol	6	100	0	67	33	60	40	60	20	50	50
Paraguay	7	71	29	40	60	14	86	71	29	14	86
Callejon de Tilo	5	100	0	50	50	40	60	60	40	60	40
Los Naranjos	5	75	25	75	25	75	25	0	100	50	50
Los Contreras	5	100	0	75	25	100	0	80	20	80	20
Cano Azul	7	100	0	50	50	20	80	40	60	71	29
Junco Verde	10	90	10	78	22	50	40	50	50	50	50
Los Peinados	7	86	14	86	14	33	67	71	29	100	0
Reventazon	10	89	11	63	38	89	11	56	44	78	22
Otros	22	100	0	71	29	36	65	70	30	55	45
Total	117	94	6	73	27	56	44	65	35	65	35

Table E.7.2 Summary of Socio-economic Survey
- Intention of Farmers on Farming Activities -

Villages	No. of Interviewees	If not irrigated, do you want to be irrigated?		If irrigated, do you want to improve actual system?		Do you want to continue cultivating the actual crops?		Do you want to expand your actual farm size?				Are you satisfied with the production of actual crops?	
								Yes			No		
		Yes	No	Yes	No	Yes	No	Compra	Tenant	Others		Yes	No
La Reforma	9	22	78	100		100		22	56	22		56	44
Barraquito	10	10		100		100		10	40	10	40	90	10
Guaraguao	9			78	22	89	11	67	22		11	67	33
Cristal	5			100		100		20		80		60	40
Borojol	6	17	17	50	33	83	17	33	17	50		83	17
Paraguay	7			57	43	100		29	14	43	14	100	
Callejon de	5	20	20	80		80	20	60	20	20		80	20
Los Naranj	5	20	20	60		60	40	20		80		60	40
Los Contre	5	40		100		100		40		20		100	
Cano Azul	7			100		86	14	14	14	14	57	86	14
Junco Verd	10	20		100		100		20	30	30	20	90	10
Los Peinad	7			100		100		14	29	29	29	100	
Reventazon	10	40		90		100		20		60		50	
Others	22	32		82		91	9	41	14	18	27	86	14
Average	**117**	**18**	**9**	**86**	**6**	**93**	**7**	**30**	**20**	**30**	**17**	**79**	**16**

Table E.8.1 Summary of Socio-economic Survey - Supplementary Survey on Cattle Farming

(1) Technical Coefficient

Survey Item	Sub-item	Unit	Survey Result
Pasture area		ha	9.01
Land tenure	Agrarian Reform	%	78.3
	Private	%	17.4
	Others	%	4.3
Inventory of animals	Cow	Head/ha	2.6
	Pregnant Heifer	Head/ha	0.8
	Heifer 1-2 years	Head/ha	1.0
	Steer 1-2 years	Head/ha	1.4
	Heifer 0-1 year	Head/ha	0.7
	Steer 0-1 year	Head/ha	0.5
	Bull	Head/ha	0.1
	Total	Head/ha	7.1
Weaning	Age	month	5.9
	Weight	kg	62.5
Interval between deliveries		month	15.5
Milk production	Volume	l/head/day	2.6
	Period	day	177
Fattening rate		gram/day	600
Proportion of improved pasture	Yes	%	48
	No	%	52

(2) Marketing of Cattle

Products	Unit head(l)/ha/year	Price RD$/head(l)	Value RD$/ha/year
Cow	0.36	4115	1,481.40
Heifer and Steer	1.64	3253	5,334.92
Milk	3256	3.73	12,144.88
Total			18,961.20

(3) Production Cost

Unit:RD$/ha/year

Initial Investment	Cattle	143
	Vehecle &	
	Equipment	374
	Fencing	497
	Sowing	460
	Sub-total	1,474
Annual cost	Cleaning	1,207
	O&M of fence	402
	Transport	120
	Fertilizer	968
	Medicine	932
	Labor cost	5,145
	Others	653
	Subtotal	9,427
Total Cost		10,901